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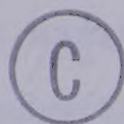
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The University of Alberta

THE EFFECT OF ISOKINETIC EXERCISE
ON HUMAN HEART RATE AND BLOOD PRESSURE

by



David J. Magee

A Thesis

Submitted to the Faculty of Graduate Studies and Research
in Partial Fulfillment of the Requirements for the Degree
of Doctor of Philosophy

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THE UNIVERSITY OF ALBERTA
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The undersigned certify that they have read,
and recommend to the Faculty of Graduate Studies and
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of Isokinetic Exercise on Human Heart Rate and Blood . . .
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of Doctor of Philosophy in Sport Sciences.

Dedication

To Wendy and Shawn

ABSTRACT

The purpose of the study was to determine the effect of isokinetic exercise on heart rate and blood pressure at three different speeds of movement and to determine if an isokinetic interval program had a cumulative effect on heart rate and blood pressure. In addition, the quadriceps and hamstring muscle groups were tested isometrically on the Cybex II isokinetic apparatus. The effects of isometric exercise on heart rate and blood pressure were observed and compared with the results found in previous studies.

The data was analyzed using a one-way, two-way, and three-way analysis of variance on repeated measures, and Tukey and Scheffe Tests. Within the confines of the study, the null hypothesis was rejected at the .001 level of confidence for isokinetic exercise at all three speeds used - thirty degrees per second, ninety degrees per second, and 150 degrees per second.

The data showed that heart rate increased with both isometric and isokinetic exercise and the increase was larger for isokinetic exercise. Systolic and diastolic blood pressure rose with isometric exercise while systolic blood pressure rose and diastolic blood

pressure fell with isokinetic exercise. The increase in systolic blood pressure was greater with isokinetic exercise than with isometric exercise.

Modified tension time index, and pulse pressure were higher during isokinetic exercise than during isometric exercise. Mean blood pressure was higher during isometric exercise.

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CHAPTER I

INTRODUCTION

Traditionally, isometric and isotonic type of exercises have been used by individuals to improve muscle power and strength. In 1967 a new form of exercise was developed by J.J. Perrine and his associates. This new form of exercise was called isokinetic exercise. This original system, called the Cybex exerciser, was the first of several similar systems which used the principle of accommodating resistance (1).

Using the principle of accommodating resistance, isokinetic offers maximum resistance through a full range of motion. Isometric exercise offers maximum resistance but only at selected points in the range of motion as no movement occurs during this type of exercise. Isotonic exercise, on the other hand, allows full range of motion but gives maximum resistance only in the weakest parts of the range of motion (2,3,4). To offer accommodating resistance, the Cybex apparatus uses an electromechanical braking mechanism. Other isokinetic devices use hydraulic

braking mechanisms (Orthotron) and a centrifugal brake arrangement (Mini-Gym).

Isokinetic exercise machines control the speed at which a joint moves through the range of motion. Some of these machines have only one speed, while others have a variable speed. The speed can be varied from zero degrees per second to 300 degrees per second depending on the device utilized.

With isokinetic exercise the muscle force transmitting capacity is accommodated through the full range of motion. The electromechanical braking mechanism of the Cybex exerciser, which is used in this study, acts as a governor to control the speed of the lever arm of the dynamometer. In so doing, the mechanism fluctuates with the changes in muscle tension and the skeletal leverage advantage by varying the load accordingly. The force of the muscles against the lever arm results in a resistance load on the lever arm which is the result of mechanical energy absorption. Thus, maximum resistance is offered only if maximum muscular tension is developed by the subject.

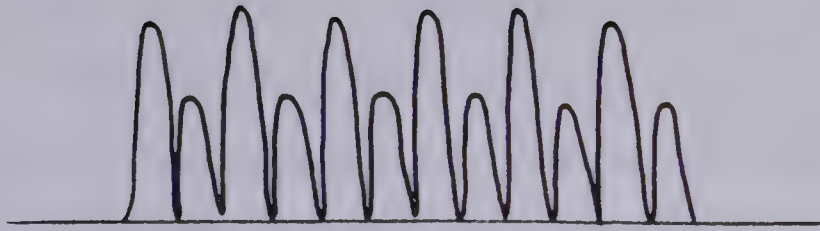
By watching the recorder showing the torque output on the Cybex machine, one is able to tell if the subject is exerting maximum effort. If the subject is exerting maximum effort, the torque curves will show an orderly

decreasing progression in peak torque height. If the subject is not exerting maximum effort, the torque curves will show a more erratic tracing of peak torque heights (see Figure 1).

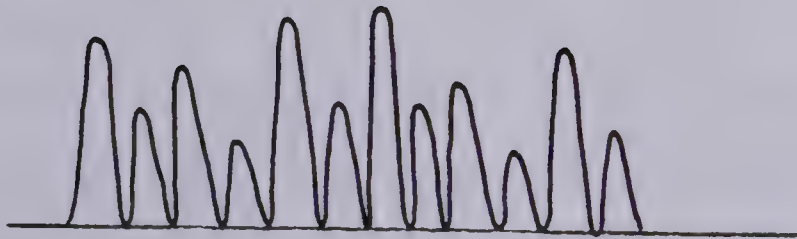
The Cybex II apparatus has several advantages. It is one of the few devices which can load a muscle maximally and still allow the limb to move through a full range of motion. In so doing, it works both the agonist and antagonist muscles around the joint. It provides a visual feedback system in the form of a dial on the dynamometer and a graphic recorder. Finally, it adjusts for pain and fatigue by its mechanism of accommodating resistance and by so doing prevents the joint being exercised from being overstressed.

Purpose of the Study

In reviewing the articles concerned with isokinetic exercise (2,3,5,6,7,8,10,11), there is a body of knowledge being developed as to the effect of isokinetic exercise on strength, power and endurance. Throughout the literature however, this is only one mention of the effect of isokinetic exercise on heart rate and blood pressure. David R. Lamb (12) in his book "Physiology of Exercise" has indicated that isokinetic exercise



(a) Peak Torque Heights with Maximum Effort



(b) Peak Torque Heights with Submaximal Effort

Figure 1: Peak Torque Heights with
Maximal and Submaximal Effort

offered "some cardiac risk as opposed to isotonic exercise offering a 'slight' risk and isometric exercise offering a 'moderate' risk". When presenting this table, Lamb offered no references to support this observation. There have been several articles concerned with the effect of isometric and/or isotonic exercise on heart rate and blood pressure (13,14,15,16,17,18,19,20,21,22, 23,24,25,26,27,28,29,30). As isokinetic exercise, in causing maximum contraction through a full range of motion of one group of muscles, causes maximum relaxation in the reciprocal muscles, the effect on heart rate and blood pressure may be different from isometric or isotonic exercise.

A review of the literature revealed that no standard rate of speed was used by authors in isokinetic exercise programs. The authors often differentiating their programs only into fast and slow speeds (2,5,6, 7,8,9,10,11,31,32).

Thus, the purpose of this study is two-fold:

- (a) to determine the effect of isokinetic exercise on heart rate and blood pressure at three different speeds of movement, and;
- (b) to determine if an isokinetic interval program has

a cumulative effect on heart rate and blood pressure.

Delimitations

1. This study is limited to three speeds on the isokinetic apparatus (30 degrees per second; 90 degrees per second, and; 150 degrees per second).
2. The study is limited to exercising one set of reciprocal muscle groups (quadriceps-hamstrings) in the lower limb.
3. The study is limited to twenty-four (24) caucasian male subjects with no known cardiovascular problems (14).
4. The study is limited to subjects between the ages of 20 years and 35 years (33,34,35,36).
5. The study is performed on a Cybex II isokinetic apparatus manufactured by Lumex Corporation, Bay Shore, New York.
6. The examiner will verbally motivate the subjects if it appears from the tape readout on the isokinetic recorder that they are not exerting maximum effort.
7. Familiarization to the Cybex apparatus and the experimental procedure is limited to one practice session immediately prior to the first test for all subjects.
8. The blood pressure was recorded using a sphygmomanometer and stethoscope (37,38,39,40).

Definition of Terms

1. Diastolic Blood Pressure: pressure in the arteries during diastole or the period of dilatation of the heart. The average auscultatory value is 80-90 mm of mercury (34,36,38).
2. Heart Rate: the number of contractions of the ventricles of the heart per unit time.
3. Isokinetic Exercise: a muscular contraction with a shortening of the muscle length against an electro-mechanical braking system at a controlled speed of movement so that the resistance is accommodating to the maximum muscle force at each point in the range of motion.
4. Isokinetic Endurance: total work done in a specified time period calculated by summing the total peak torques.
5. Isometric Exercise: a muscular contraction with minimal muscle shortening and the joint exhibits no perceivable movement.
6. Korotkoff Sounds: sounds heard or recorded during auscultatory blood pressure determination when the

pressure in a blood pressure cuff is allowed to fall to zero from a pressure which is great enough to occlude circulation.

- (a) the first sound heard (a clear tapping or thumping sound) indicates the passage of blood under the cuff and represents the systolic pressure.
- (b) the moment the sounds disappear, the blood passes freely through the artery and represents the diastolic pressure. This is sometimes called the second diastolic pressure (34,41).

7. Mean Blood Pressure: the blood pressure calculated by taking two-thirds of the diastolic pressure plus one-third of the systolic pressure (42). It is an indication of the driving force required to drive the blood through the circulatory system.

8. Modified Tension Time Index (MTTI): an indication of the oxygen consumption of the heart (43,44,45,46). It is calculated using the following formula:

$$\text{MTTI} = \frac{\text{Heart Rate} \times \text{Systolic Blood Pressure}}{100}$$

9. Peak Torque: the highest torque reading on the graph during each contraction.

10. Pulse Pressure: the numerical difference between the systolic and diastolic blood pressures.

11. Systolic Blood Pressure: pressure in the arteries during systole or the period of contraction of the heart. The average auscultatory value is 120-130 mm of mercury.
12. Torque: a force perpendicular to a lever arm which is rotating about an axes of rotation.

Basic Assumptions

This study proceeded on the following assumptions:

1. The subjects performed each test working maximally at all times.
2. The exercises performed were sufficiently strenuous to cause an effect on the cardiovascular system.
3. Under the conditions which the study was conducted, the changes which were noted, if any, were the result of the isokinetic exercise.

Hypothesis

The following null hypothesis was investigated:

If isokinetic exercise is performed during an interval program using the quadriceps and hamstring muscle groups on normal male subjects, there will be no significant change in the heart rate or blood pressure of the subjects during the exercise or after the exercise. Three speeds of isokinetic exercise were used (thirty degrees per second, ninety

degrees per second, and 150 degrees per second).

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CHAPTER II

REVIEW OF LITERATURE

The review of literature is organized into four areas. Firstly are the general principles of isokinetic exercise; secondly are the effects of isometric exercise on heart rate and blood pressure; thirdly are the effects of isometric exercise on heart rate and blood pressure; and finally, is the neurological control of circulation.

General Principles of Isokinetic Exercise

The original isokinetic exerciser was developed by J.J. Perrine and associates in 1967. Isokinetic exercise offers maximum resistance through a full range of motion. This is accomplished by controlling the speed of contraction. Depending on the apparatus used, this speed is either set by the manufacturer or can be adjusted by the operator of the device. This speed control provides voluntary concentric contractions which may be reciprocal depending on the apparatus used (1,2).

Acceleration and thus inertia only occurs until

the predetermined speed of the apparatus is reached. Once the speed is reached, the force applied by the subject is converted to torque rather than acceleration. This torque is proportional to the magnitude of the muscular force and is exhibited on the dial of a dynamometer and on a recorder. It is this value of force output at a slow velocity of the muscle which is often referred to as strength, but in reality is a measurement of power in isokinetic tests (3,4,5,6,7,8).

The torque or strength measure is a product of the force which acts about an axis of rotation times the perpendicular distance from the axis of rotation. The torque value will vary through the range of motion due to the lever system of the human body and neuro-physiological factors. Thus, it is important to consider stabilization of the subject, joint alignment (centre of joint as close as possible to the axes of rotation), and, shaft length of the dynamometer when performing testing on an isokinetic apparatus (6,8,9, 10,11).

Peak torque or the maximum torque reading provides an easy reference when comparing the musculature across two joints. The peak torque is easy to note and when taken over time can provide an average peak torque to

note any improvement. For example, Moffroid et al (8) state that a difference of greater than ten percent when testing the same muscles indicates a strength deficit in the weaker muscle.

In isokinetic terms, torque may also be considered work. Because the lever arm is kept constant for each subject, work, which is force times distance, is the area under the torque curve. The work accomplished by the subject can be determined by the formula:

$$\text{WORK} = T \times 2 \times d,$$

where T is the torque in foot pounds and d is the portion of the arc travelled (1,2,5,8,11,12).

Power as demonstrated on the isokinetic apparatus is a mechanical measurement of work done per unit time. It is determined by the formula:

$$\text{POWER} = \frac{\text{Torque} \times 2 \times \text{revolutions per minute}}{\text{time (minutes)}}$$

It is this average power output during a given time frame which constitutes a definition of endurance in isokinetic terms (5,6,8,11,12).

When using isokinetic exercise for research and testing, one must be aware that a definite learning curve is present during the first few sessions. Thus it is important in studies where the torque values are of primary importance that each subject be given

sufficient time to learn how to use the apparatus (7).

Moffroid et al. (8) have shown that using slow speed isokinetic exercise will increase torque values at slow velocities. Fast speed isokinetic exercise will increase torque values at all speed settings up to the fast speed but not to as high a torque value reading as was accomplished at the slow speed. Fast speed isokinetic exercise also increased the endurance of muscles exercised.

Reliability of isokinetic exercise was found to be high in terms of torque, range of motion and speed measurement provided certain conditions were met. A period of warm up and familiarization of the apparatus is required as well as proper stabilization and positioning of the apparatus. As well, the lever arm length must be constant for each subject. Reliability coefficients ranged from 0.93 to 0.99 (13,14,15,16).

Effect of Isotonic Exercise on Heart Rate and Blood Pressure

Tuttle and Horvath (17) found that when their subjects exercise on a bicycle ergometer at a work load of 1250 kilogram -meters for one minute, there was a rise in systolic blood pressure from 125 mm of mercury to 173 mm of mercury while the diastolic pressure remained

virtually the same, fluctuating from 83 mm of mercury to 87 mm of mercury.

Lind and McNicol (18) found that rhythmic exercise caused an increase in heart rate as well as an increase in systolic blood pressure. At the same time, a decrease in the diastolic pressure was found. The authors felt that these effects resulted from a large increase in blood flow through the muscles during the period of intermittent relaxation which had the effect of delaying fatigue.

Kramer (19) found that with treadmill walking by elderly subjects, the heart rate increased gradually with the exercise value after one minute being significantly greater than the resting heart rate value. Kramer also found that the systolic pressure increased with exercise while diastolic pressure remained virtually the same.

Effect of Isometric Exercise on Heart Rate and Blood Pressure

Bartels et al. (20) found that heart rate increased with isometric exercise but did not reach a maximum value until immediately after the cessation of exercise. This was then followed by a drop in heart rate to resting

levels, in some cases, within twenty seconds. At the same time, Bartels and his associates found that systolic blood pressure increased throughout the exercise bout (maximal arm and leg isometric contraction for ten seconds) reaching a maximum value immediately following exercise. In most cases, the systolic pressure returned to resting levels within two and a half minutes. Diastolic changes were found to be small and in most cases return to resting level within two minutes.

Kivowitz et al. (21) found that when subjects were asked to hold a dynamometer at 25% maximum voluntary contraction for five minutes, there was an increase in mean arterial pressure and heart rate. The authors felt this was suggestive of an increase in sympathetic tone predominating over baroreceptor-induced increase in vagal tone.

Lind and McNicol (18) found that heart rate and blood pressure changes were noted even during low contraction tensions such as 15 per cent maximum voluntary contraction. The authors felt that if sustained exercises were performed during rhythmic exercises, the reflex hemodynamic effects of the sustained contractions could be beneficial. Lind and McNicol stated that the

blood flowing through the muscles performing the rhythmic exercise would be enhanced by the increase in perfusion pressure caused by the sustained contraction. The cardiac output during the isometric contractions tended to be higher than during isotonic exercise and the authors felt this would benefit the muscles performing rhythmic exercise.

In another study, Lind and McNicol (22) found that during isometric contraction of 5-10 percent maximum voluntary contraction, the heart rate and blood pressure both increased and reached a steady state when the contraction was held for three minutes. At tensions of 15-20-30 per cent maximum voluntary contraction, again the heart rate and blood pressure increased but a steady state was not reached. Donald et al. (23) reported similar data.

Thompson (24) found that isometric exercise resulted in an increase in both systolic and diastolic blood pressure while isotonic exercise caused an increase in systolic pressure only, while the diastolic pressure remained relatively constant. Thompson also found that the systolic blood pressure returned to near resting levels faster (within one minute) following isometric exercise while the diastolic pressure returned to resting levels within three to four minutes.

Hoel et al. (25) showed similar changes in hypertensive subjects. The hypertensive subjects did show a higher value for systolic and diastolic pressure than did the normotensive subjects, but these subjects also started with higher resting values.

Nagle (26) stated that one of the problems encountered with isometric exercise was that of breath holding or the valsalva manoeuvre which is holding the breath and straining against a closed glottis. The valsalva manoeuvre causes an acute rapid increase in blood pressure. The high intrathoracic pressure reduces venous return and the arterial pressure falls causing a reflex vasoconstriction of peripheral arterioles. Thus a pressure load can occur to the heart.

Other studies in the literature (27,28,29,30,31,32, 33) have shown similar results. The degree of blood pressure elevation depends on the degree of isometric contraction. As the tension of the isometric contraction increases, the blood pressure elevation is more marked and occurs more rapidly. During isometric contractions of 15 per cent maximum voluntary contraction or less, the blood pressure elevation plus vasodilation of the muscle vascular tissues provides adequate blood flow to meet the metabolic needs of the contracting muscles. At contractions of greater than 15 per cent maximum voluntary contraction, the throttling effect of the mechanical

compression caused by the contracting muscles results in inadequate blood flow to meet the metabolic requirements of the tissues (28). At contractions of 70 per cent maximum voluntary contraction, the intramuscular tension developed during the isometric exercise occludes the blood supply and leads to early fatigue.

Neurological Control of Circulation

In a working muscle, extra blood is needed to ensure its proper functioning. The resultant vasodilation in the working muscle is primarily due to the release of vasoconstrictor tone rather than by activity of vasodilator fibers although these cholinergic fibers do play a part. The peripheral vasoconstriction is mediated by the α -adrenorgic receptors of the peripheral autonomic nervous system (34,35,36,37,38).

Alterations in blood pressure are the result of a reflex response of pressoreceptors and chemoreceptors. As the blood pressure increases, these receptors increase their frequency of firing. These receptors located in the carotid sinus travel to the brain stimulating the central and autonomic nervous systems. This stimulation reduces the effect of the arterial baroreceptors reflex and the result is a rise in both heart rate and blood pressure (39,40,41,42).

The heart rate increase seen with exercise is initiated by the release of vagal tone followed by sympathetic stimulation of the heart. The central control of the heart rate during exercise depends on several factors. The impulses from receptors in joints and the working muscles are received by the brain in proportion to the rate and amount of work performed. Cardio-accelerator reflexes in the carotid and aortic bodies reacting to chemical stimulation can increase the heart rate. Finally, depressor reflexes from the receptors in the carotid sinus and aortic arch can depress the vagal control over the heart enabling the heart to beat faster (43,44,45).

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CHAPTER III

METHODS AND PROCEDURES

Sample Selection

The sample consisted of twenty-four male caucasian volunteer subjects between the ages of twenty-one years and thirty-five years . The program involved one exercise session of isometric exercise followed by three exercise sessions of isokinetic exercise (1,2,3,4,5,6, 7,8). The subjects had no known cardiac, pulmonary or blood pressure problems as determined by a medical questionnaire (9,10,11). Subjects were instructed to refrain from smoking, eating, drinking or exercising for at least four hours prior to each test session (12,13, 14).

Apparatus

The isokinetic apparatus used in the study was the Cybex II system manufactured by the Lumex Corporation. The concept of isokinetic exercise has been discussed previously in Chapter I (page 1-3).

The Cybex II isokinetic system consisted of three components:

1. A dynamometer which measures torque inputs up to 360 foot-pounds. The input attachment supplies a resistance which automatically varies to accommodate the force applied by the subject. Any force applied to the input shaft is recorded on a recorder as well as being displayed on a dial on the front of the dynamometer. The force is recorded as torque in foot-pound units.
2. A speed selector which presets the speed of rotation of the dynamometer from zero to 300 degrees per second (zero to fifty revolutions per minute). The lever arm of the dynamometer cannot be accelerated beyond the set speed regardless of the input torque applied. As more force is exerted against the lever arm of the dynamometer, more resistance is encountered by the subject's limb.
3. A two speed recorder (two millimeters per second and fifty millimeters per second) with heated stylus, records and displays a permanent record of the applied torque.

The recorder of the Cybex apparatus was connected to a Hewlett Packard four channel recorder (model 7754A) by means of a Hewlett Packard bioelectric amplifier (model 8811A) so that the heart rate and torque readings could be recorded simultaneously.

The Cybex II Isokinetic System as used and connected to the four channel recorder is shown in Figure 2. Figure 3 illustrates the permanent record of torque output (channel one), heart rate (Channel two), and heart beats (Channel four) on the paper of the four channel recorder.

Blood pressure measurements were made on a Medisco mercurial sphygmomanometer manufactured in West Germany (Figure 4). The adult blood pressure cuff was placed around the middle third of the upper arm at the level of the heart, evenly and snugly, without constriction. The sphygmomanometer blood pressure cuff was inflated to about 200 millimeters of mercury and the pressure was released at a rate of reduction of about two to three millimeters of mercury per second (15,16,17,18,19,20, 21,22,23).

The sphygmomanometer provided an indirect auscultatory measurement of systolic and diastolic pressure. A review of the literature indicated that the auscultatory method was accurate if performed by the same individual (24,25,26,27). Although the blood pressure readings, when taken by the auscultatory method, were slightly higher than they would have been if taken by the direct method, the auscultatory method was used as it presented less danger to the subjects.



Figure 2: Isokinetic Apparatus

(a) Cybex II Isokinetic Apparatus, Hewlett Packard
Four Channel Recorder and Timer



Figure 2: Isokinetic Apparatus

(b) Dynamometer of Isokinetic Apparatus

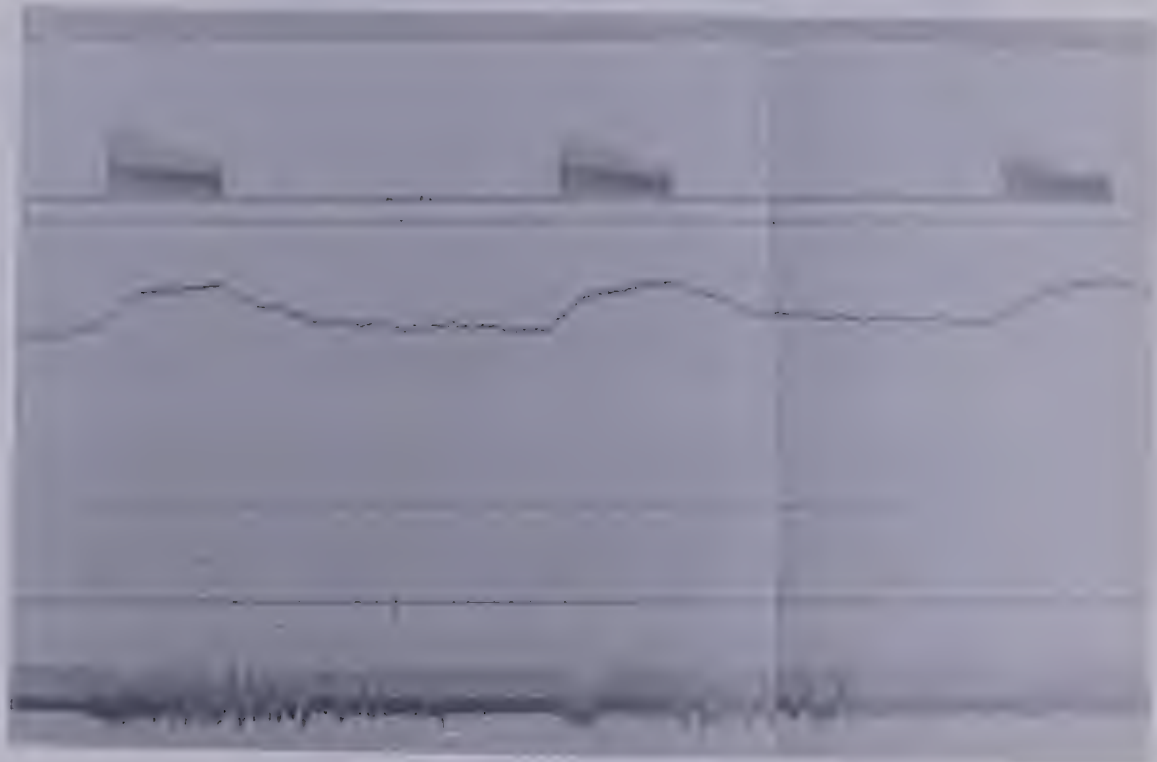


Figure 3: Recording on Four Channel Recorder.

Top Recording is torque output (channel one);
Second Recording is heart rate (channel two);
and Bottom Recording is heart beat
(channel four).



Figure 4: Medisco Mercurial Sphygmomanometer

The first (systolic pressure) and fifth (diastolic pressure) Korotkoff sounds were noted by auscultation of the brachial artery in the anti-cubital fossa.

Heart rate measurements were made on the Hewlett Packard four channel recorder. The electrodes were placed on each subject as shown in Figure 5. The multi-channel lead was attached to a Hewlett Packard bioelectric amplifier (model 8811A) which gave the heart beat reading on channel four. The bioelectric amplifier was attached to a Hewlett Packard rate computer (model 8812A) which gave the heart rate on channel two (Figures 6 and 7).

Initial Familiarization

The twenty-four male subjects came to the strength laboratory in the Faculty of Rehabilitation Medicine, where they were placed in the isokinetic apparatus as shown in Figure 8. The investigator explained the isokinetic principle of maximum resistance through a full range of motion to the subjects. The investigator then fully explained the experimental procedure to the subjects who were asked to complete a personal data form and to sign an informed consent form (Appendix B and C). The subjects were given an opportunity to prac-



Figure 5: Electrode placement for
Recording Heart Rate



Figure 6: Four Channel Recorder
Showing Bioelectric Amplifiers
and Rate Computer



Figure 7: Connection Between Bioelectric Amplifier and Rate Computer to Record Heart Rate



Figure 8: Subject Placement in Isokinetic Apparatus

tise using the dynamometer at the speeds selected for the project.

Isometric Testing Procedure

Following familiarization of the isokinetic dynamometer, the subject was allowed a rest period of ten minutes. During the first five minutes, the blood pressure cuff and electrocardiogram leads were attached to the subject.

Each subject's left arm rested at their side on a supporting cushion. The adult size blood pressure cuff was placed around the middle third of the upper arm.

The subjects were then seated in the test apparatus and attached to the dynamometer apparatus as shown in Figure 8. The input shaft of the dynamometer was placed lateral to the subject's knee with its axis of rotation coinciding as closely as possible with the axis of rotation of the knee joint (28,29). Each subject was held in position by straps around the waist, the thigh, and the right leg proximal to the ankle. This latter strap attached the subject to the isokinetic apparatus. The position of the back rest of the isokinetic table was adjusted so that the hip angle is between 110 degrees and 120 degrees (30).

Once positioned in the isokinetic apparatus, each

subject was allowed to perform five or six contractions in each direction to allow him to get set and comfortable in the apparatus.

Each subject was then allowed a five minute rest period to allow the heart rate and blood pressure to stabilize near resting levels. During this period the heart rate and blood pressure were recorded every minute. The heart rate was recorded on the minute and the blood pressure cuff was inflated five seconds prior to the minute. The timing of the heart rate and blood pressure measurements was by means of a Gra-Lab Timer (model 171).

While the subject was resting, the angle of the right knee was set at sixty degrees of flexion (full extension considered zero degrees) to prepare for the isometric extensor test. This angle has been found to be the angle which demonstrates the highest isometric force for the knee extensors (31,32,33). To do the isometric test, the angle of the leg was set and the speed selector was set at zero degrees per second.

Following the ten minute rest, the subject was asked to perform one maximum voluntary contraction (MVC) of the quadriceps muscles of the right leg and was asked to hold the contraction as long as possible. The heart

rate and blood pressure were recorded every minute during the contraction.

Following the MVC, each subject was allowed a five minute rest period with heart rate and blood pressure being recorded every minute. During this rest period, the investigator determined seventy percent MVC, thirty percent MVC and ten percent MVC (17, 34, 35, 36, 37, 38) (Appendix G).

Following this rest period, each subject was asked to perform one of the percentage MVC of the quadriceps of the right leg. They were asked to hold the contraction for as long as possible to a maximum of three minutes. The percentage MVC was assigned according to a Latin Square design (Appendix K). The heart rate and the blood pressure were noted every minute. Each subject was then allowed another five minute rest period (39).

This procedure was repeated for the other two percentage maximum voluntary contractions (70%, 30% or 10%) to a maximum contraction time of three minutes for each session.

Following completion of the three percentage MVC's for the quadriceps, each subject was given a ten minute rest, five minutes of which could be used to move about, and a second five minutes during which the heart rate and

blood pressure were recorded in the sitting position.

During the second five minute rest, the angle of the right knee was set at forty-five degrees of flexion to prepare for the isometric flexor test. This angle has been found to be the angle which demonstrates the highest isometric force for the knee flexors (31,32, 33). As previously described, the speed selector is set at zero degrees per second for the isometric contraction.

Following the ten minute rest period, each subject was asked to perform one MVC of the hamstrings of the right leg and was asked to hold the contraction as long as possible to a maximum of three minutes. The heart rate and the blood pressure were recorded every minute.

Following the MVC, each subject was allowed another five minute rest period with heart rate and blood pressure being recorded every minute. During this period, the investigator determined 70%, 30% and 10% MVC (Appendix G). For the following three tests, these percentage maximum voluntary contractions were assigned for each subject to do according to the Latin Square design as indicated for the quadriceps muscle group (Appendix K).

Following the second five minute rest, each subject was asked to perform one of the three percentage

maximum voluntary contractions of the hamstrings of the right leg and was asked to hold the contraction as long as possible to a maximum of three minutes. The heart rate and blood pressure were recorded every minute. Each subject was then allowed another five minute rest period during which the heart rate and blood pressure were recorded.

This procedure was repeated for the other two percentage maximum voluntary contractions of the hamstrings as was done with the quadriceps muscle. The time frame for the isometric sessions is illustrated in Figure 9.

Isokinetic Interval Testing Procedure

During the subsequent three visits to the strength laboratory, each subject was asked to perform an isokinetic interval program at three assigned speeds set on the speed selector of the isokinetic apparatus. The three speeds were thirty degrees per second, ninety degrees per second, and 150 degrees per second. The speeds were assigned according to a Latin Square design (Appendix K).

The program for each speed of the Cybex isokinetic dynamometer was the same, only the dynamometer speeds were changed. Each subject did the three isokinetic sessions and the isometric session at the same time of

5 Minute Rest Period Recorded
Percentage MVC for up to 3 minutes for Hamstrings
5 Minute Rest Period Recorded
Percentage MVC for up to 3 minutes for Hamstrings
5 Minute Rest Period Recorded
Percentage MVC for up to 3 minutes for Hamstrings
5 Minute Rest Period Recorded
MVC for up to 3 minutes for Hamstrings
5 Minute Rest Period Recorded
5 Minute Rest Period Recorded
Percentage MVC for up to 3 minutes for Quadriceps
5 Minute Rest Period Recorded
Percentage MVC for up to 3 minutes for Quadriceps
5 Minute Rest Period Recorded
Percentage MVC for up to 3 minutes for Quadriceps
5 Minute Rest Period Recorded
MVC for up to 3 minutes for Quadriceps
5 Minute Rest Period Recorded
5 Minute Rest Period Not Recorded
Familiarization Period

Start

Figure 9: Time Frame for Isometric Sessions
Total time: 75 Minutes

day but on different days (40).

Each subject was positioned as previously described for the isometric test (Figure 8), and the electrocardiograph electrodes and blood pressure cuff were positioned as previously described.

Once positioned in the isokinetic apparatus, each subject was allowed to perform five or six contractions at the selected speed in each direction (flexion and extension of the knee) through a full range of motion to allow the subject to become comfortable and adjusted in the apparatus.

Each subject was then allowed a five minute rest period to allow the heart rate and blood pressure to stabilize at a normal resting level. During this period the heart rate and blood pressure was recorded every minute. The heart rate was recorded on the minute and the blood pressure cuff was inflated five seconds prior to the minute.

Following the five minute rest period, each subject was asked to flex and extend his right knee through a full range of motion as hard and as fast as he could for one minute at one of the designated speeds. The subject was then allowed a three minute rest-relief period (41). The heart rate and blood pressure were recorded every minute during the rest period and contraction time.

The process of work and rest-relief were continued for a total of three sets (41). Following completion of the third set, heart rate and blood pressure were recorded until both returned to near pre-exercise levels.

On the subsequent two visits, the program was the same as described above, but with different dynamometer speeds. The time frame for the Isokinetic Interval training sessions is illustrated in Figure 10.

Statistical Treatment

One-way, two-way and three-way analyses of variance with repeated measures on one factor were used to analyse the data. These methods are described in Winer (42). These methods offer the advantage of each subject acting as his own control. Thus the variability due to average different responses of all subjects is eliminated from the experimental error.

The data was tested at the .01 level of significance for the analysis of variance as well as for the Tukey Test and Scheffe Test.

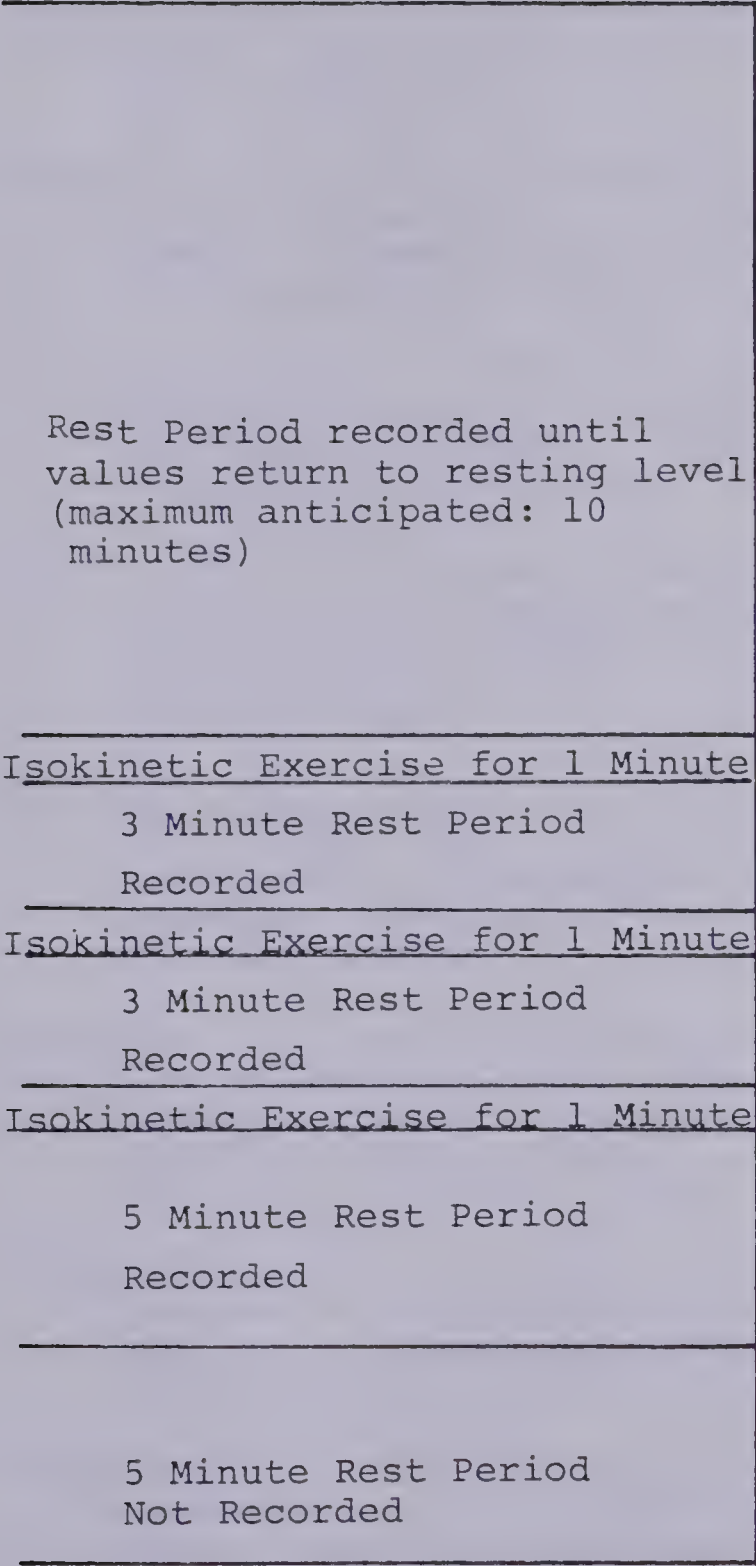


Figure 10: Time Frame for Isokinetic Interval Training
Total Time/Session: 30 Minutes

Start

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CHAPTER IV

RESULTS

The purpose of this study was to determine the effect of isokinetic exercise on heart rate and blood pressure at three different speeds of movement and to determine if an isokinetic interval program had a cumulative effect on heart rate and blood pressure. In addition, the quadriceps and hamstring muscle groups were tested isometrically on the Cybex II isokinetic apparatus. The effects of isometric exercise on heart rate and blood pressure were observed and compared with the results found in previous studies. A sample of twenty-four subjects was studied.

The results and discussion will be divided into three parts as follows (a) effect of isometric exercise on heart rate and blood pressure; (b) effect of isokinetic exercise on heart rate and blood pressure and; (c) comparison of the effect of isometric and isokinetic exercise on heart rate and blood pressure. The raw data and format statements for each procedure are found in appendices L and M respectively.

Effect of Isometric Exercise on Heart Rate and Blood Pressure

The method used for the statistical analysis of

the data for heart rate during isometric rest periods was a two-way analysis of variance on repeated measures.

In the analysis, the terms groups and trials refer to the following: (1) Group - in the testing of isometric exercise, there were five rest periods. The first rest period was pre-exercise or pre-maximum voluntary contraction. The second, third, and fourth rest periods were pre-seventy percent, pre-thirty percent and pre-ten percent respectively. The final rest period was the post-test reading. (2) Trials refers to the five readings for each subject within each group. That is, each subject had five resting values for each of the rest periods.

Table I shows the values obtained in the two-way analysis of variance for heart rate using quadriceps and hamstring muscle groups. Significant interaction occurred between each of the groups over the five trials with no pattern emerging. Primary interaction was between the post-test values.

The method used for the statistical analysis of the data for systolic and diastolic blood pressure during isometric rest periods was a two-way analysis of variance on repeated measures. In the analysis, the terms groups and trials refer to the same terms as used in the analysis of heart rate data for isometric rest periods.

Table I

Analysis of Variance for Heart Rate During Isometric Rest Periods for
(1) Quadriceps and (2) Hamstring Muscle Groups

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
1. Quadriceps					
GROUPS	634.500	4.	158.625	0.256	0.906
	71357.000	115.	620.496		
TRIALS	2101.501	4.	525.375	12.190	0.001
GROUPS/TRIALS	4765.500	16.	297.844	6.911	0.001
INTERACTION	19825.000	460.	43.098		
2. Hamstrings					
GROUPS	571.500	4.	142.875	0.272	0.896
	60425.000	115.	525.435		
TRIALS	2799.002	4.	699.750	16.477	0.001
GROUPS/TRIALS	2809.502	16.	175.594	4.135	0.001
INTERACTION	19536.000	460.	42.470		

Table II shows the values obtained in the two-way analysis of variance for systolic and diastolic blood pressure using quadriceps and hamstring muscle groups. Significant interaction for systolic blood pressure occurred primarily between the pre-test value and the first post-test value. As well, for trials three, four, and five, interaction did occur between the post-test values for the quadriceps muscle group. For the hamstrings muscle group, the interaction for systolic blood pressure was between the pre-exercise value and the post-exercise values.

The method used for the statistical analysis of the data for mean blood pressure, modified tension time index, and pulse pressure during isometric rest periods using quadriceps and hamstring muscle groups was a one-way analysis of variance on repeated measures. In the analysis, the term trials refers to the rest periods.

Table III shows the values obtained in the one-way analysis of variance for mean blood pressure, modified tension time index and pulse pressure for quadriceps and hamstrings muscle groups.

A Tukey Test performed on the trials for mean blood pressure, modified tension time index, and pulse pressure during isometric rest periods showed a

Table II
 Analysis of Variance for (a) Systolic Blood Pressure and (b) Diastolic Blood
 Pressure During Isometric Rest Periods Using (1) Quadriceps
 and (2) Hamstring Muscle Groups

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
1. Quadriceps					
(a) Systolic Blood Pressure					
GROUPS	4489.500	4.	1122.375	2.133	0.081
	60500.000	115.	526.087		
TRIALS	2517.001	4.	629.250	46.128	0.001
GROUPS/TRIALS	1243.501	16.	77.719	5.697	0.001
INTERACTION	6275.000	460.	13.641		
(b) Diastolic Blood Pressure					
GROUPS	454.500	4.	113.625	0.312	0.869
	41842.000	115.	363.843		
TRIALS	99.000	4.	24.750	1.970	0.098
GROUPS/TRIALS	277.500	16.	17.344	1.381	0.146
INTERACTION	5779.000	460.	12.563		

Table II continued

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
2. Hamstrings					
(a) Systolic Blood Pressure					
GROUPS	1609.501	4.	402.375	0.907	0.463
	51028.000	115.	443.722		
TRIALS	1639.501	4.	409.875	32.773	0.001
GROUPS/TRIALS	618.000	16.	38.625	3.088	0.001
INTERACTION	5753.000	460.	12.507		
(b) Diastolic Blood					
Pressure					
GROUPS	208.500	4.	52.125	0.141	0.967
	42548.000	115.	369.982		
TRIALS	18.000	4.	4.500	0.388	0.817
GROUPS/TRIALS	208.500	16.	13.031	1.125	0.329
INTERACTION	5329.000	460.	11.585		

Table III

Analysis of Variance for (a) Mean Blood Pressure, (b) Modified Tension Time Index, and (c) Pulse Pressure During Isometric Rest Periods Using (1) Quadriceps and (2) Hamstring Muscle Groups

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
1. Quadriceps					
(a) Mean Blood Pressure	39711.000	119.	33.706		
TRIALS	371.250	4.	92.813	11.075	0.001
	3989.000	476.	8.380		
(b) Modified Tension Time Index	129327.000	119.	1086.781		
TRIALS	5980.781	4.	1495.195	16.087	0.001
	42347.000	476.	88.964		
(c) Pulse Pressure	45937.000	119.	386.027		
TRIALS	2280.000	4.	570.000	24.565	0.001
	11044.938	476.	23.204		

Table III continued

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
2. Hamstrings					
(a) Mean Blood Pressure	36839.000	119.	309.571		
TRIALS	190.781	4.	47.695	6.636	0.001
	3421.000	476.	7.187		
(b) Modified Tension Time Index					
	96552.000	119.	811.361		
TRIALS	4498.125	4.	1124.531	13.920	0.001
	38454.000	476.	80.786		
(c) Pulse Pressure					
	41063.750	119.	345.073		
TRIALS	1655.625	4.	413.906	18.680	0.001
	10547.063	476.	22.158		

significant difference occurred between those trials shown in Table IV. The differences in mean blood pressure, modified tension time index and pulse pressure for quadriceps and hamstring muscle groups are shown in Figures 11, 12, and 13, respectively.

As indicated in Figure 11, the pre-exercise mean blood pressure value for the quadriceps muscle group was found to be significantly different from the post-exercise values. Furthermore, no significant differences were found among the post-exercise mean blood pressure values. For the hamstring muscle group, the pre-exercise mean blood pressure value was found to be significantly different from the last three post-exercise mean blood pressure values. No significant differences were found between the post-exercise mean blood pressure values for the hamstrings muscle group.

The pre-exercise modified tension time index value for the quadriceps muscle group was found to be significantly different from the following three post-exercise values. The pre-exercise value was not significantly different from the final post-test value. The third and fourth post-exercise modified tension time indices were significantly different from the final

Table IV

Significant Differences Between Trials Using Tukey Test* for Mean Blood Pressure, Modified Tension Time Index, and Pulse Pressure During Isometric Rest Periods Using Quadriceps and Hamstring Muscle Groups

QUADRICEPS	HAMSTRINGS
(a) Mean Blood Pressure	(a) Mean Blood Pressure
98.196 - 96.756	97.022 - 95.857
98.196 - 95.993	97.022 - 95.352
98.196 - 96.195	97.002 - 95.637
98.196 - 96.375	
*critical value = 1.22 @ $\alpha = .01$	*critical value = 1.13 @ $\alpha = .01$
(b) Modified Tension Time Index	(b) Modified Tension Time Index
89.493 - 84.768	83.460 - 79.423
89.493 - 81.533	83.460 - 79.694
89.493 - 80.983	83.460 - 77.470
81.533 - 86.441	79.423 - 84.844
80.983 - 86.441	79.694 - 84.844
*critical difference = 3.96 @ $\alpha = .01$	*critical value = 3.77 @ $\alpha = .01$
(c) Pulse Pressure	(c) Pulse Pressure
44.133 - 41.408	41.008 - 37.992
44.133 - 40.633	41.008 - 37.558
44.133 - 39.025	41.008 - 36.842
44.133 - 38.717	41.008 - 36.200
41.408 - 39.025	
41.408 - 38.717	
*critical value = 2.02 @ $\alpha = .01$	*critical value = 1.98 @ $\alpha = .01$

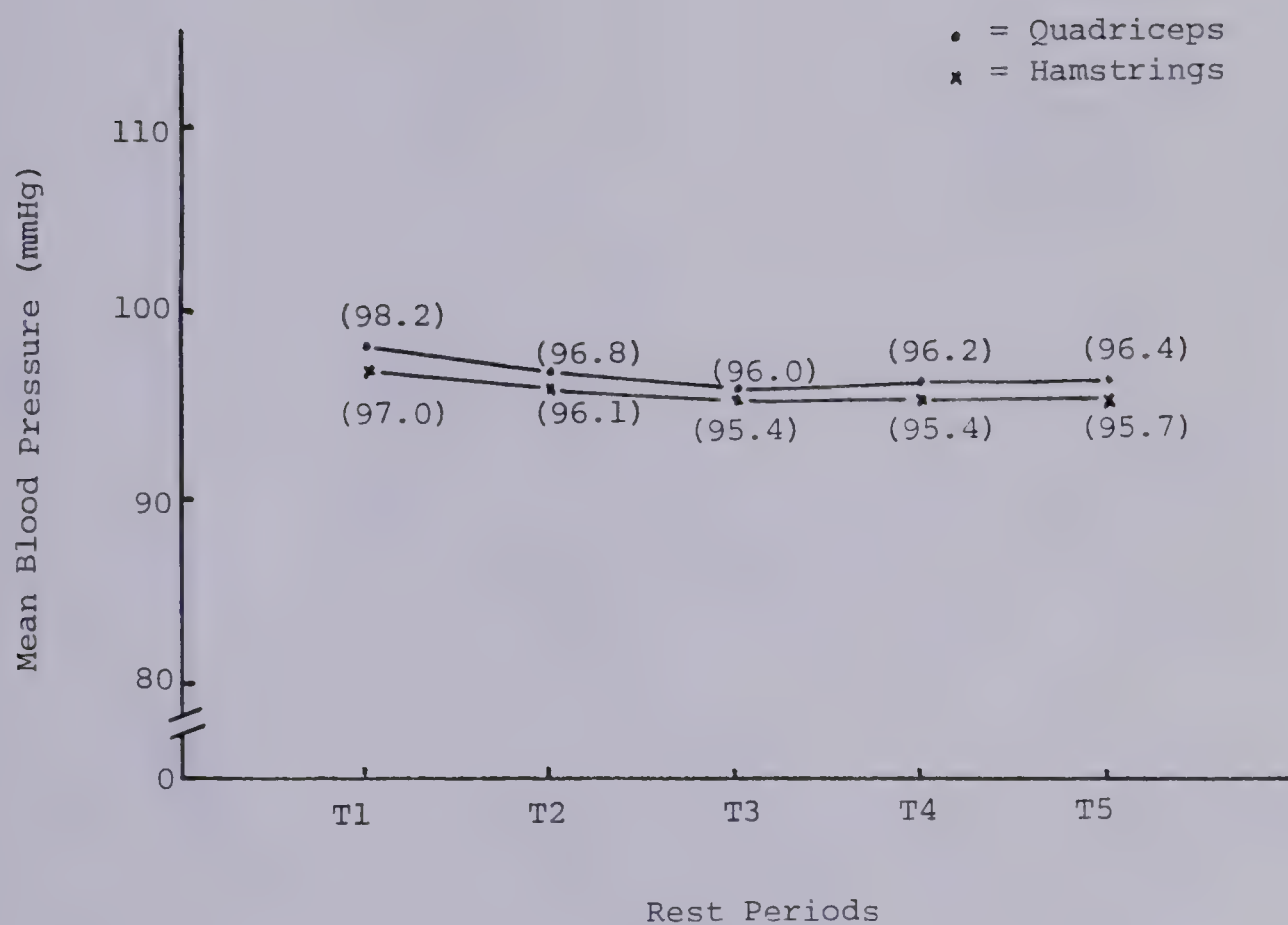


Figure 11: Mean Blood Pressure During Isometric Rest Periods Using Quadriceps and Hamstring Muscle Groups

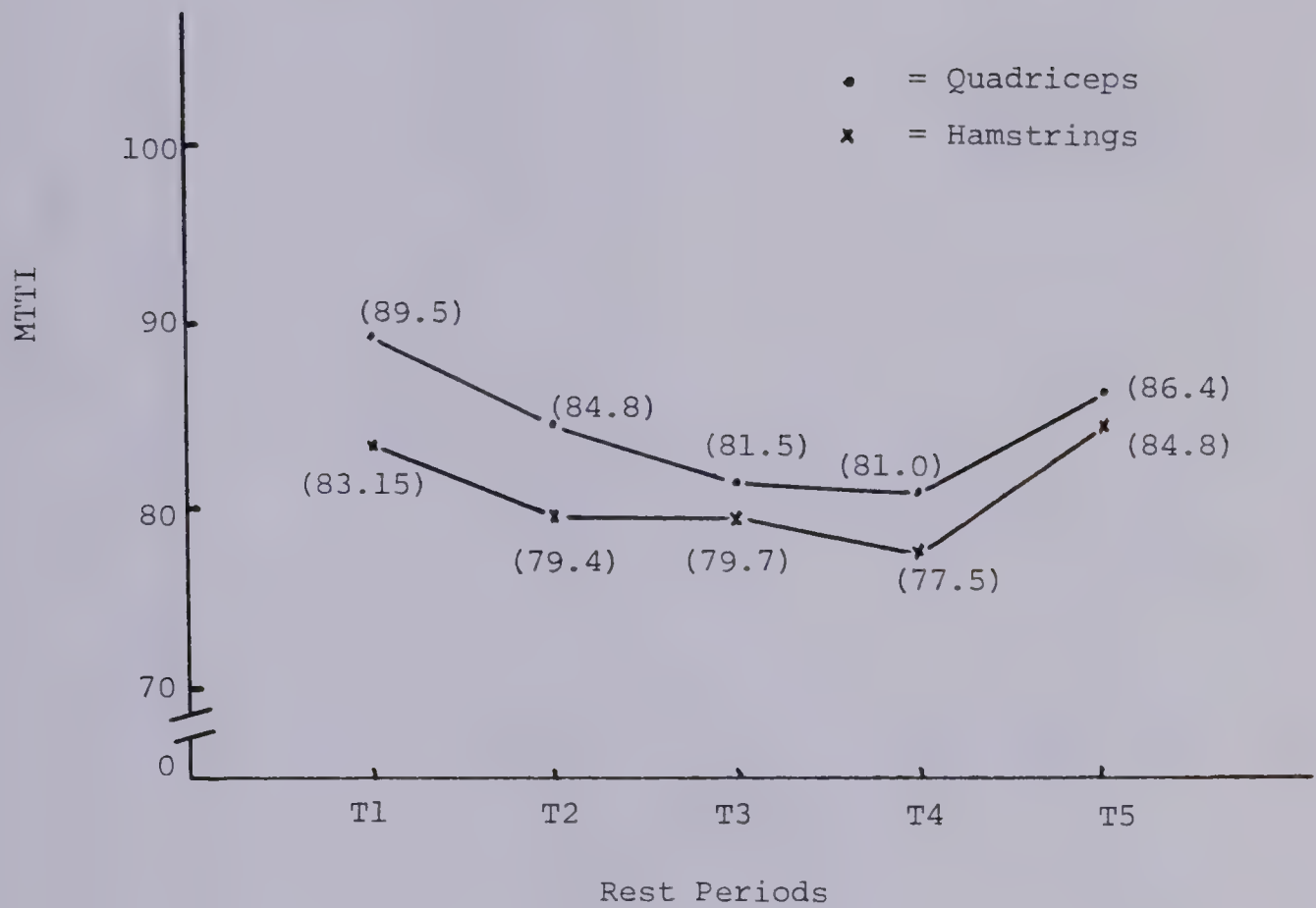


Figure 12: Modified Tension Time Index During Isometric Rest Periods Using Quadriceps and Hamstring Muscle Groups

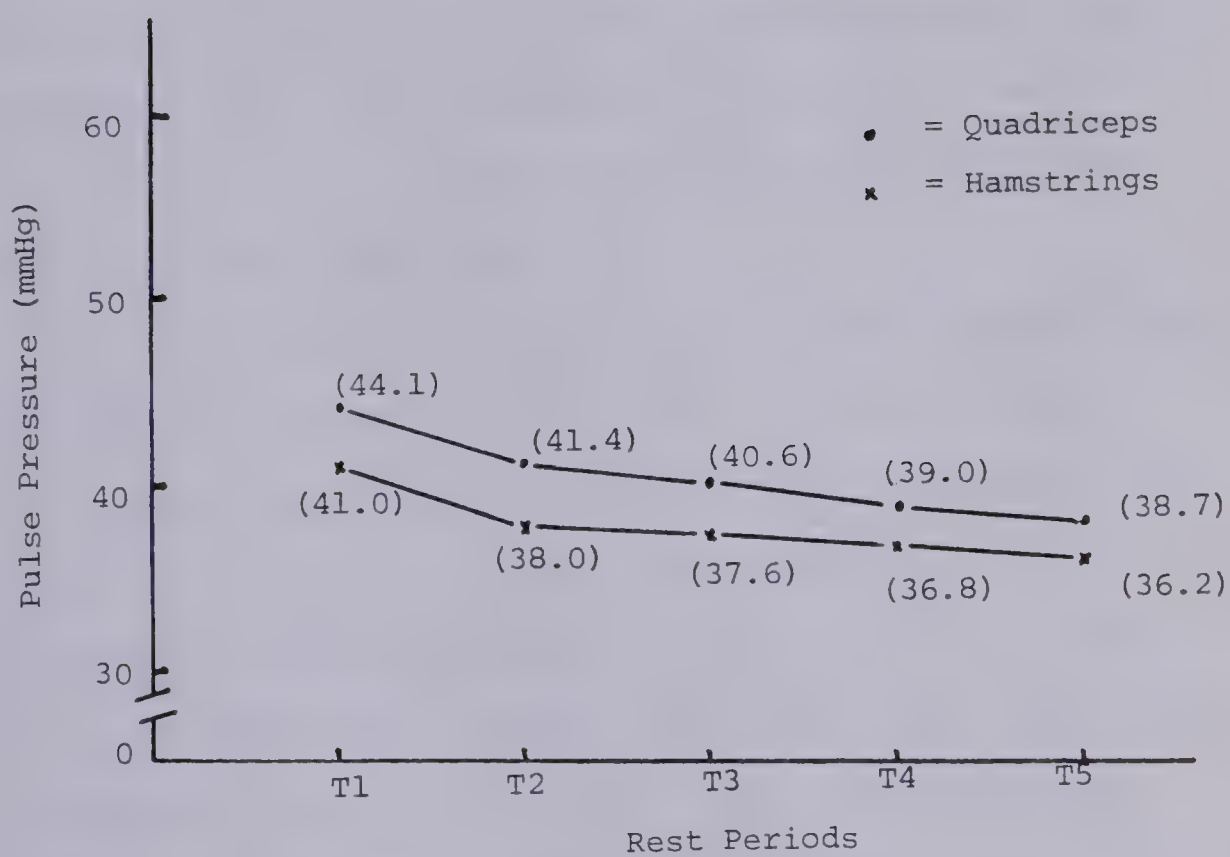


Figure 13: Pulse Pressure During Isometric Rest Periods Using Quadriceps and Hamstring Muscle Groups

post-exercise values. Similarly, the pre-exercise modified tension time index for the hamstring muscle group was found to be significantly different from the following three post-exercise values. Again, the pre-exercise modified tension time index was not significantly different from the final post-exercise value. The second and third post-exercise modified tension time indices were significantly different from the final post-exercise value.

As indicated in Figure 13, the pre-exercise pulse pressure for the quadriceps muscle group was found to be significantly different from the post-exercise values. As well, the first post-exercise value was found to be significantly different from the final three post-exercise values. There were no significant differences between the final three post-exercise values. For the hamstring muscle group, the pre-exercise pulse pressure was significantly different from the post-exercise values. There were no significant differences between the post-exercise pulse pressure values.

The method used for the statistical analysis of the data for heart rate during isometric exercise using the quadriceps and hamstrings was a one-way analysis of variance on repeated measures. In the analysis,

the term treatment refers to the percentage strength of the isometric contraction. Trial one is maximum voluntary contraction (MVC); trial two is seventy percent MVC; trial three is thirty percent MVC; and, trial four is ten percent MVC.

Table V shows the values obtained in the one-way analysis of variance for heart rate during isometric exercise bouts using quadriceps and hamstrings.

A Tukey Test performed on the trials for the heart rate during isometric exercise bouts showed a significant difference occurred between those trials shown in Table VI.

As indicated in Figure 14, for the quadriceps muscle group, there were significant differences in heart rate between MVC, and thirty and ten percent MVC; between seventy percent MVC, and thirty and ten percent MVC, and; between thirty percent MVC and ten percent MVC. For the hamstring muscle groups, there were significant differences in heart rate between MVC, and seventy, thirty, and ten percent MVC, and between seventy percent MVC and, thirty and ten percent MVC.

The method used for the statistical analysis of the data for systolic and diastolic blood pressure during isometric exercise bouts using quadriceps and hamstring muscle groups was a one-way analysis of variance

Table V

Analysis of Variance for Heart Rate During Isometric Exercise Bouts
using (1) Quadriceps and (2) Hamstring Muscle Groups

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
1. Quadriceps					
	21641.688	23.	940.943		
TREATMENT	42543.375	3.	14181.125	93.963	0.001
	10413.688	69.	150.923		

2. Hamstrings					
	15599.375	23.	678.234		
TREATMENT	36083.438	3.	12027.813	71.405	0.001
	11622.625	69.	168.444		

Table VI

Significant Differences Between Treatments Using
Tukey Test* for Heart Rate During Isometric Exercise
Bouts Using Quadriceps and Hamstring Muscle Groups

QUADRICEPS	HAMSTRINGS
120.208 - 85.000	114.917 - 101.625
120.208 - 69.208	114.917 - 73.917
114.833 - 85.000	114.917 - 67.875
114.833 - 69.208	101.625 - 73.917
85.000 - 69.208	101.625 - 67.875
*critical value = 11.51 @ $\alpha = .01$	*critical value = 12.16 @ $\alpha = .01$

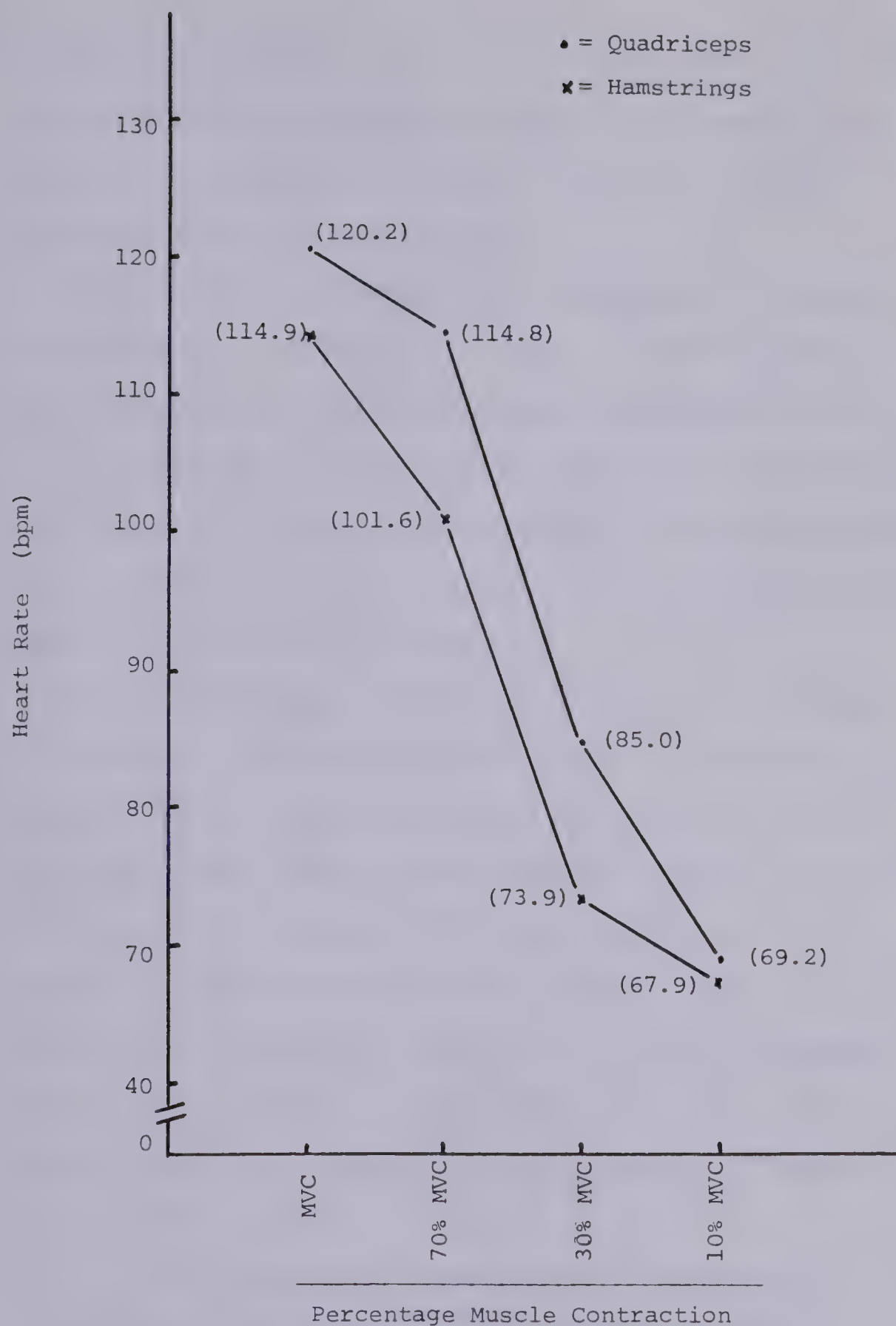


Figure 14: Heart Rate During Isometric Exercise Bouts Using Quadriceps and Hamstring Muscle Groups (MVC = maximum voluntary contraction)

on repeated measures. In the analysis, the term rest refers to the percentage strength of isometric contraction as the term treatment previously did in isometric exercise heart rate.

Table VII shows the values obtained in the one-way analysis of variance for systolic and diastolic blood pressure for quadriceps and hamstrings muscle groups.

A Tukey Test performed on the trials for systolic and diastolic blood pressure during isometric exercise bouts showed a significant difference occurred between those trials shown in Table VIII.

As indicated in Figure 15, for the quadriceps muscle group, there were significant differences in the systolic blood pressure between MVC, and thirty and ten percent MVC, and between seventy percent MVC and thirty and ten percent MVC. For diastolic blood pressure, the quadriceps muscle group showed significant differences between MVC, and thirty and ten percent MVC; between seventy percent MVC, and thirty and ten percent MVC; and, between thirty percent MVC and ten percent MVC.

For the hamstring muscle group, there were significant differences in the systolic blood pressure between MVC and seventy, thirty, and ten percent MVC; between seventy percent MVC, and thirty and ten percent

Table VII

Analysis of Variance for (a) Systolic Blood Pressure and (b) Diastolic Blood Pressure During Isometric Exercise Bouts Using (1) Quadriceps and (2) Hamstring Muscle Groups

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
1. Quadriceps					
(a) Systolic	13538.000	23.	588.609		
REST	13764.000	3.	4588.000	40.986	0.001
(Treatment)	7724.000	69.	111.942		
(b) Diastolic	4404.438	23.	239.323		
REST	9848.813	3.	3282.938	41.544	0.001
(Treatment)	5452.563	69.	79.023		
2. Hamstrings					
(a) Systolic	9173.000	23.	398.826		
REST	17487.000	3.	5829.000	77.720	0.001
(Treatment)	5175.000	69.	75.000		
(b) Diastolic	5697.938	23.	247.736		
REST	14813.063	23.	4937.688	76.681	0.001
(Treatment)	4443.063	69.	64.392		

Table VIII

Significant Differences Between Trials (Rest) Using Tukey Test* for (1) Systolic Blood Pressure and (2) Diastolic Blood Pressure During Isometric Exercise Bouts Using Quadriceps and Hamstring Muscle Groups

QUADRICEPS	HAMSTRINGS
Systolic Blood Pressure	Systolic Blood Pressure
160.917 - 140.33	159.874 - 145.042
160.917 - 130.667	159.875 - 134.000
155.292 - 140.333	159.875 - 123.458
155.292 - 130.667	145.042 - 134.000
	145.042 - 123.458
	134.000 - 123.458
*critical value = 9.91 @ $\alpha = .01$	*critical value = 8.11 @ $\alpha = .01$
Diastolic Blood Pressure	Diastolic Blood Pressure
115.250 - 99.333	115.542 - 106.917
115.250 - 89.417	115.542 - 88.833
111.042 - 99.333	115.542 - 85.667
111.042 - 89.417	106.917 - 88.833
99.333 - 89.417	106.917 - 85.667
*critical value = 8.33 @ $\alpha = .01$	*critical value = 7.52 @ $\alpha = .01$

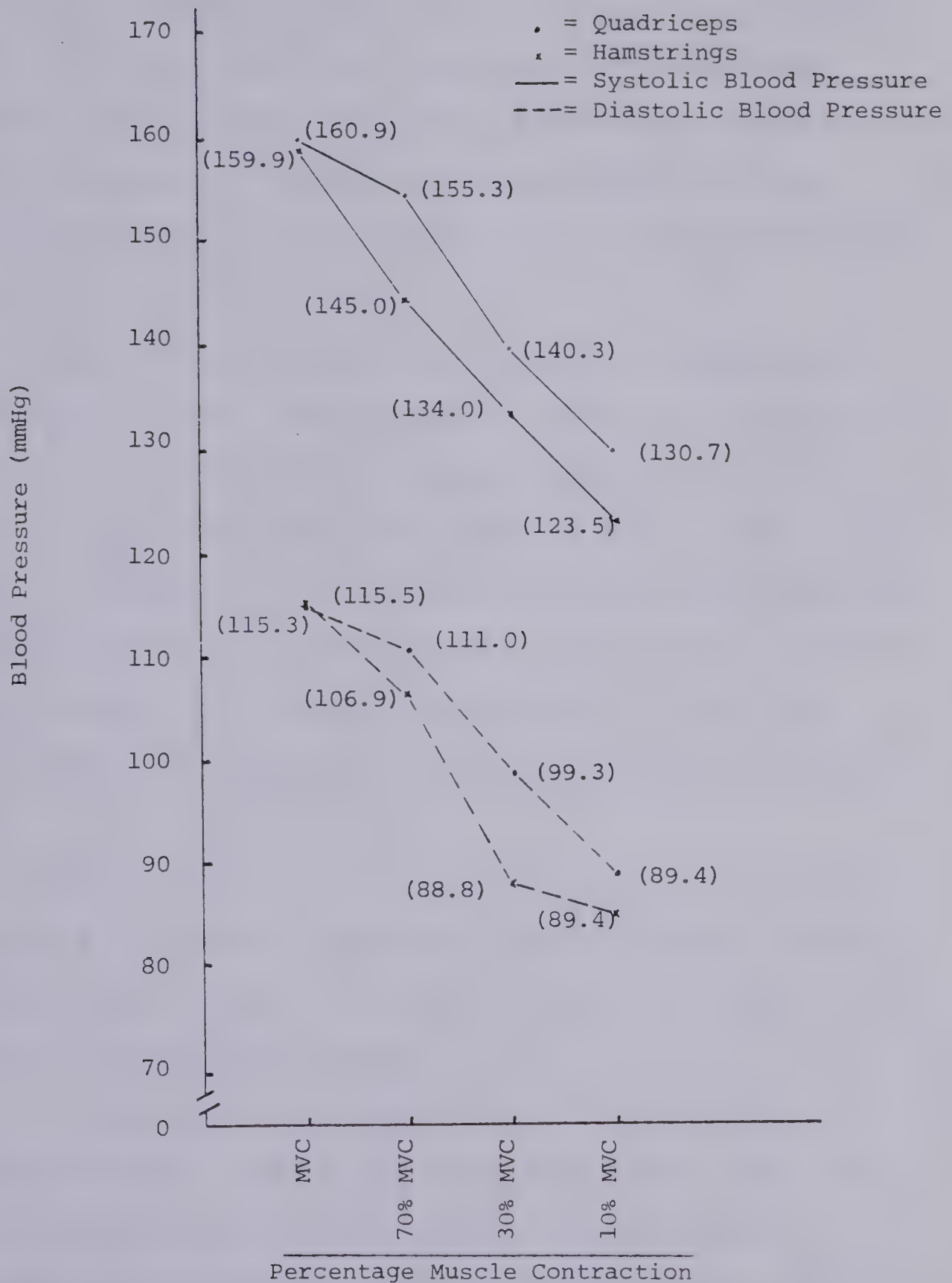


Figure 15: Systolic and Diastolic Blood Pressure During Isometric Exercise Bouts Using Quadriceps and Hamstring Muscle Groups (MVC = maximum voluntary contraction)

MVC; and, between thirty percent MVC and ten percent MVC. For diastolic blood pressure, the hamstrings muscle group showed significant differences between MVC, and seventy, thirty, and ten percent MVC and, between seventy percent MVC and thirty and ten percent MVC.

The method used for the statistical analysis of the data for mean blood pressure, modified tension time index, and pulse pressure during isometric exercise bouts using quadriceps and hamstring muscle groups was a one-way analysis of variance on repeated measures. In the analysis, the term trials refers to the percentage strength of isometric contraction as the term treatment previously did in isometric exercise heart rate.

Table IX shows the values obtained in the one-way analysis of variance for mean blood pressure, modified tension time index, and pulse pressure for quadriceps and hamstring muscle group.

A Tukey Test performed on the trials for mean blood pressure, modified tension time index, and pulse pressure during isometric exercise bouts showed a significant difference occurred between those trials shown in Table X. The differences in mean blood pressure and modified tension time index for quadriceps

Table IX

Analysis of Variance for (a) Mean Blood Pressure, (b) Modified Tension Time Index, and (c) Pulse Pressure During Isometric Exercise Bouts Using (1) Quadriceps and (2) Hamstrings Muscle Groups

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
1. Quadriceps					
(a) Mean Blood Pressure					
	6692.000	23.	290.956		
TRIALS	11047.969	3.	3682.656	53.744	0.001
	4728.000	69.	68.522		
(b) Modified Tension Time Index					
	55412.000	23.	2409.217		
TRIALS	171765.000	3.	57255.000	86.226	0.001
	45817.000	69.	664.014		
(c) Pulse Pressure					
	6634.375	23.	288.451		
TRIALS	377.438	3.	125.813	1.312	0.278
	6618.000	69.	95.913		

Table IX continued

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
2. Hamstrings					
(a) Mean Blood Pressure	5620.000	23.	244.348		
TRIALS	15425.906 3760.000	3. 69.	5141.969 54.493	94.361	0.001
(b) Modified Tension Time Index					
	40019.000	23.	1739.956		
TRIALS	153214.500 43312.000	3. 69.	51071.500 627.710	81.362	0.001
(c) Pulse Pressure					
	1116.656	3.	372.219	6.222	0.001
TRIALS	4127.750	69.	59.822		

Table X

Significant Differences Between Trials Using Tukey Test*
for Mean Blood Pressure, Modified Tension Time Index and
Pulse Pressure During Isometric Exercise Bouts Using
Quadriceps and Hamstring Muscle Groups

QUADRICEPS	HAMSTRINGS
(a) Mean Blood Pressure	(a) Mean Blood Pressure
130.342 - 112.887	130.190 - 119.506
130.342 - 103.063	130.190 - 103.785
125.665 - 112.887	130.190 - 98.116
125.665 - 103.063	119.505 - 103.785
112.887 - 103.063	119.505 - 98.166
*critical value = 7.76 @ $\alpha = .01$	*critical value = 6.92 @ $\alpha = .01$
(b) Modified Tension Time Index	(b) Modified Tension Time Index
193.694 - 119.017	184.261 - 148.103
193.694 - 90.570	184.261 - 98.897
173.900 - 119.017	184.261 - 83.619
173.900 - 90.570	148.103 - 98.897
119.017 - 90.570	148.103 - 83.619
*critical value = 24.14 @ $\alpha = .01$	*critical value = 23.47 @ $\alpha = .01$
(c) Pulse Pressure	(c) Pulse Pressure
no significance	45.167 - 37.792
	*critical value = 7.25 @ $\alpha = .01$

and hamstring muscle groups are shown in Figures 16 and 17.

As shown in Figure 16, for the quadriceps muscle group, there were significant differences in the mean blood pressure between MVC, and thirty and ten percent MVC; between seventy percent, and thirty and ten percent MVC; and, between thirty percent MVC and ten percent MVC. For the hamstrings muscle group, there were significant differences between MVC, and seventy, thirty, and ten percent MVC, and between seventy percent MVC, and thirty and ten percent MVC.

For the quadriceps muscle group, there were significant differences in the modified tension time index between MVC, and thirty and ten percent MVC; between seventy percent MVC, and thirty and ten percent MVC; and, between thirty percent MVC and ten percent MVC. For the hamstring muscle group, there were significant differences between MVC, and seventy, thirty, and ten percent MVC, and between seventy percent MVC, and thirty and ten percent MVC. There is no significant difference in pulse pressure between the percentage contractions for the quadriceps muscle group. For the hamstring muscle group, there is a significant difference in pulse pressure between thirty percent MVC and ten percent MVC only.

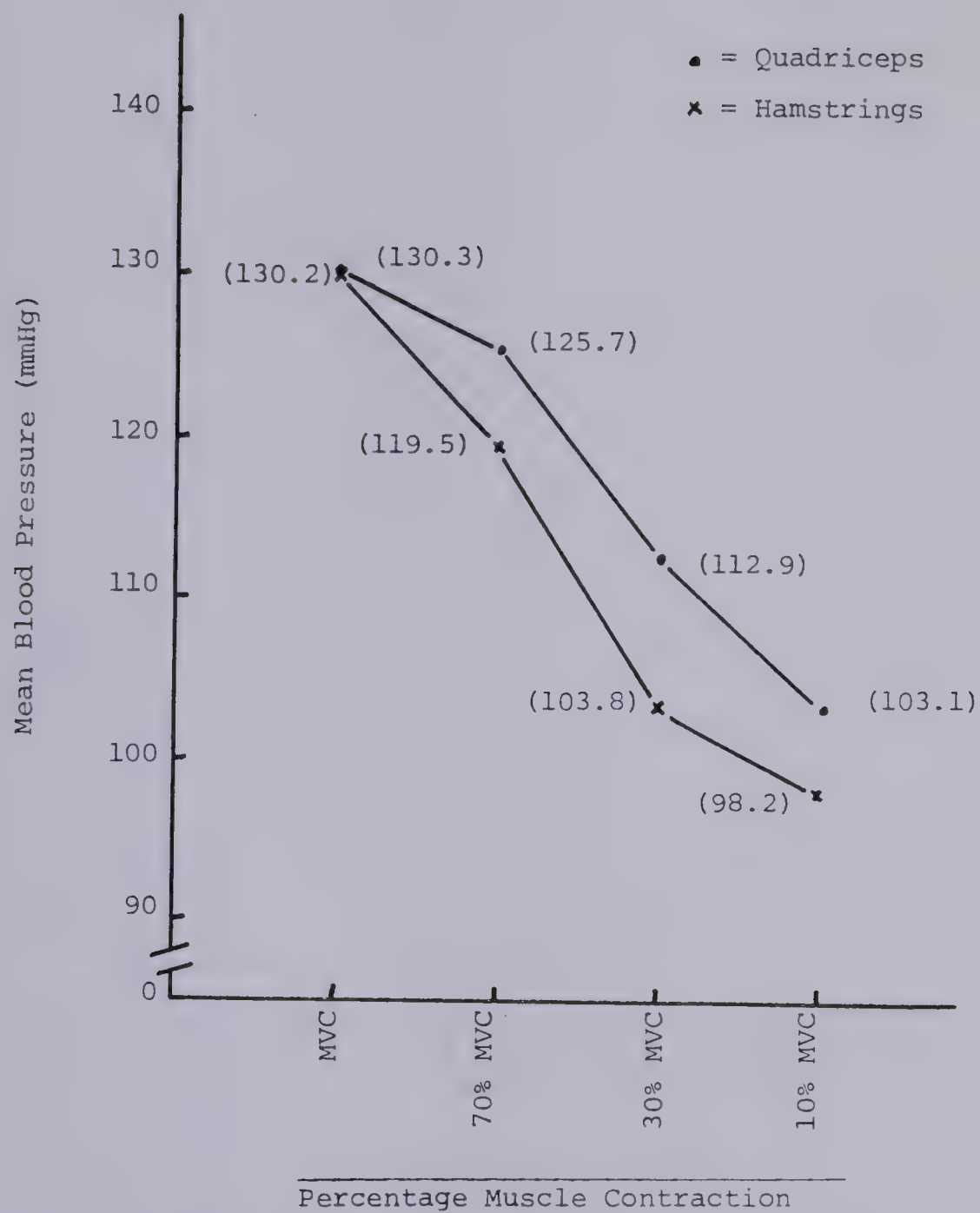


Figure 16: Mean Blood Pressure During Isometric Exercise Bouts Using Quadriceps and Hamstring Muscle Groups (MVC = maximum voluntary contraction)

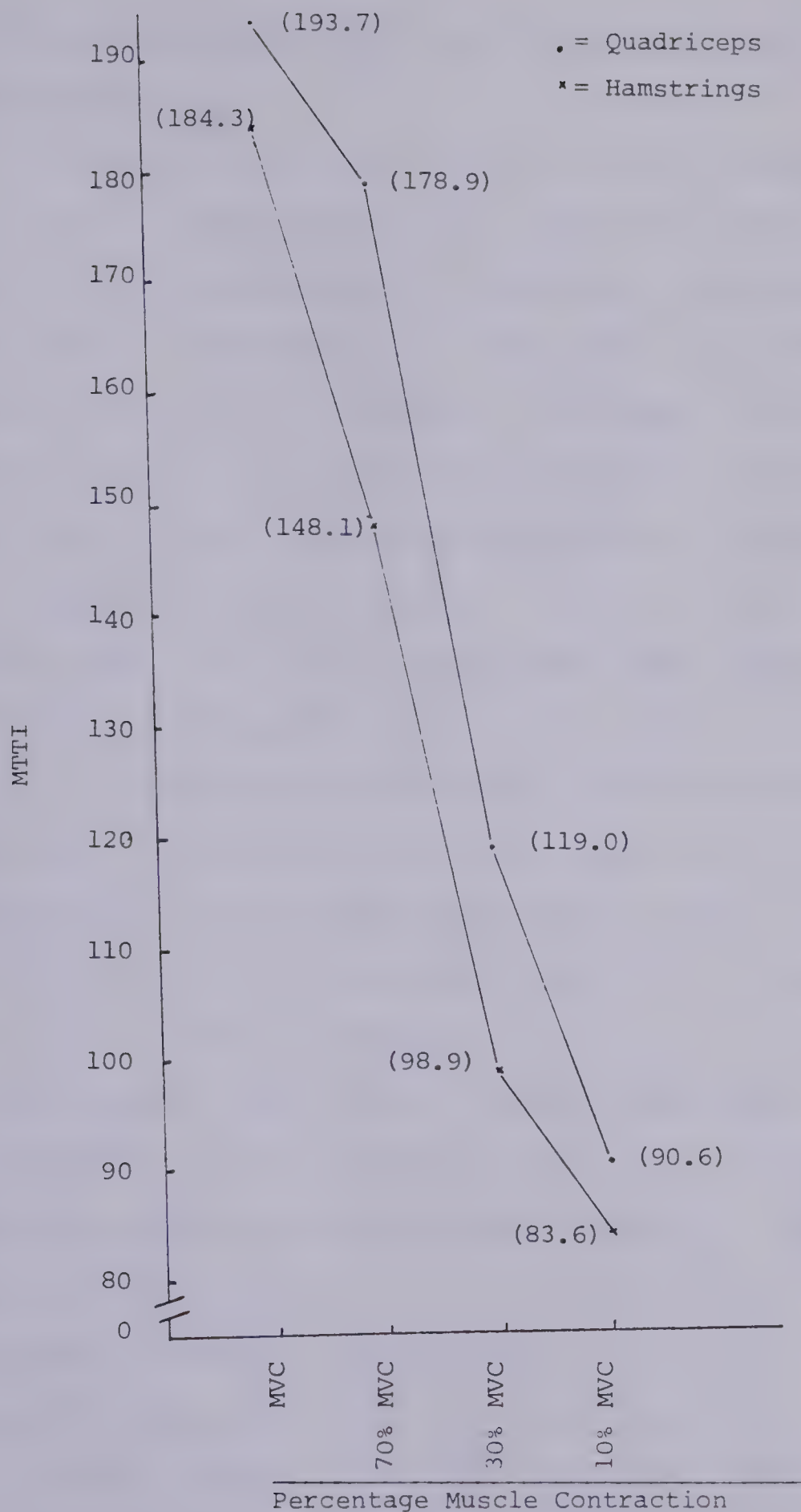


Figure 17: Modified Tension Time Index During Isometric Exercise Bouts Using Quadriceps and Hamstring Muscle Groups (MVC = maximum voluntary contraction)

Effect of Isokinetic Exercise on Heart Rate and Blood Pressure

The method used for the statistical analysis of the data for heart rate during isokinetic rest periods was a three-way analysis of variance on repeated measures. In the analysis, the terms speed, rest, and trials refer to the following: (1) speed - three speeds were chosen for the isokinetic apparatus - 30 degrees per second (low), 90 degrees per second (medium), and 150 degrees per second (high); (2) rest - the rest periods were set up as follows: one rest period of three minutes duration prior to exercise, one rest period of three minutes duration following each of the first two isokinetic exercise bouts, and three rest periods of three minutes each following the third exercise bout. This sequence was used to establish an isokinetic interval program of one minute followed by a three minute rest with the final three-three minute rest periods used to allow the heart rate and blood pressure return to near resting levels; (3) Trials refers to the order in which the selected speed of isokinetic exercise was performed during the isokinetic interval session for that particular test day.

Table XI shows the values obtained in the three-way analysis of variance for heart rate during isokinetic rest periods. Significant differences were

Table XI

Analysis of Variance for Heart Rate During Isokinetic Rest Periods

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
	176233.00	23.	7662.301		
SPEED	11625.000	2.	5812.500	7.860	0.001
	34019.000	46.	739.532		
REST	79564.500	5.	15912.898	71.134	0.001
	25726.000	115.	223.704		
SPEED/REST INTERACTION	6075.000	10.	607.500	10.067	0.001
	13880.000	230.	60.348		
TRIALS	4770.000	2.	2385.000	28.131	0.001
	3900.000	46.	84.783		
SPEED/TRIALS INTERACTION	336.000	4.	84.000	2.204	0.075
	3507.000	92.	38.120		
REST/TRIALS INTERACTION	9954.000	10.	995.400	22.329	0.001
	10253.000	230.	44.578		
REST/SPEED/ TRIALS INTER- ACTION	582.000	20.	29.100	0.799	0.716
	16757.000	460.	36.428		

found between the different speeds, between the different rest periods, and between the different trials. Significance in the interaction was found between speed and rest, and rest and trials.

The data showed that the significant interaction between speed and rest occurred primarily between the initial rest period and the first post-exercise period. There was also an interaction between the first and second post-exercise rest periods for the medium and high speeds.

For the interaction between rest and trials, the main significant interaction occurred between the pre-exercise period or initial rest period and the first post-test exercise period, as well as between the second post-exercise rest period and the third post-exercise period.

The method used for statistical analysis of the data for both systolic and diastolic blood pressure during isokinetic rest periods was a three-way analysis of variance on repeated measures. In the analysis, the terms speed, rest, and trials refer to the same terms as used in analysis of heart rate data for isokinetic rest periods.

Table XII shows the values obtained in the three-way analysis of variance for systolic blood pressure during isokinetic rest periods. Significant differences were found between the different speeds, between the different rest periods, and between the different trials. Significance in the interaction was found between speed and rest, and rest and trials.

The data showed that the significant interaction between speed and rest occurred primarily between the initial rest period and the first post-exercise period. The main significant interaction between rest and trials occurred again between the pre-exercise rest period and the first post-test period.

Table XIII shows the values obtained in the three-way analysis of variance for diastolic blood pressure during isokinetic rest periods. Significant differences were found only between the different rest periods.

The method of statistical analysis of the data for mean blood pressure, modified tension time index, and pulse pressure during isokinetic rest periods was a one-way analysis of variance on repeated measures. In the analysis, the term trials refers to the rest periods before and after the exercise bouts. There was one rest period of three minutes duration prior to

Table XII

Analysis of Variance for Systolic Blood Pressure During Isokinetic
Rest Periods

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
	99904.000	23.	4343.648		
SPEED	8914.500	2.	4457.250	10.301	0.001
	19904.000	46.	432.696		
REST	160503.000	5.	32100.598	152.092	0.001
	24272.000	115.	211.061		
SPEED/REST INTERACTION	4299.000	10.	429.900	6.609	0.001
	14960.000	230.	65.043		
TRIALS	25054.500	2.	12527.250	290.450	0.001
	1984.000	46.	43.130		
SPEED/TRIALS INTERACTION	57.000	4.	14.250	0.635	0.639
	2064.000	92.	22.435		
REST/TRIALS INTERACTION	13965.000	10.	1396.500	76.330	0.001
	4208.000	230.	18.296		
SPEED/REST/ TRIALS INTER- ACTION	189.000	20.	9.450	0.536	0.951
	8112.000	460.	17.635		

Table XIII
Analysis of Variance for Diastolic Blood Pressure During
Isokinetic Rest Periods

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
	110651.000	23.	4810.910		
SPEED	1951.500	2.	975.750	0.944	0.396
	47547.000	46.	1033.630		
REST	18972.000	5.	3794.400	4.697	0.001
	92903.000	115.	807.852		
SPEED/REST	6681.000	10.	668.100	0.947	0.491
	162342.000	230.	705.835		
TRIALS	1452.000	2.	726.000	0.948	0.391
	34866.000	46.	757.956		
SPEED/TRIALS INTERACTION	1768.500	4.	442.125	0.673	0.612
	60455.000	92.	657.119		
REST/TRIALS INTERACTION	9120.000	10.	912.000	1.390	0.186
	150884.000	230.	656.017		
SPEED/REST/ TRIALS INTERACTION	15748.500	20.	787.425	1.211	0.240
	299063.000	460.	650.137		

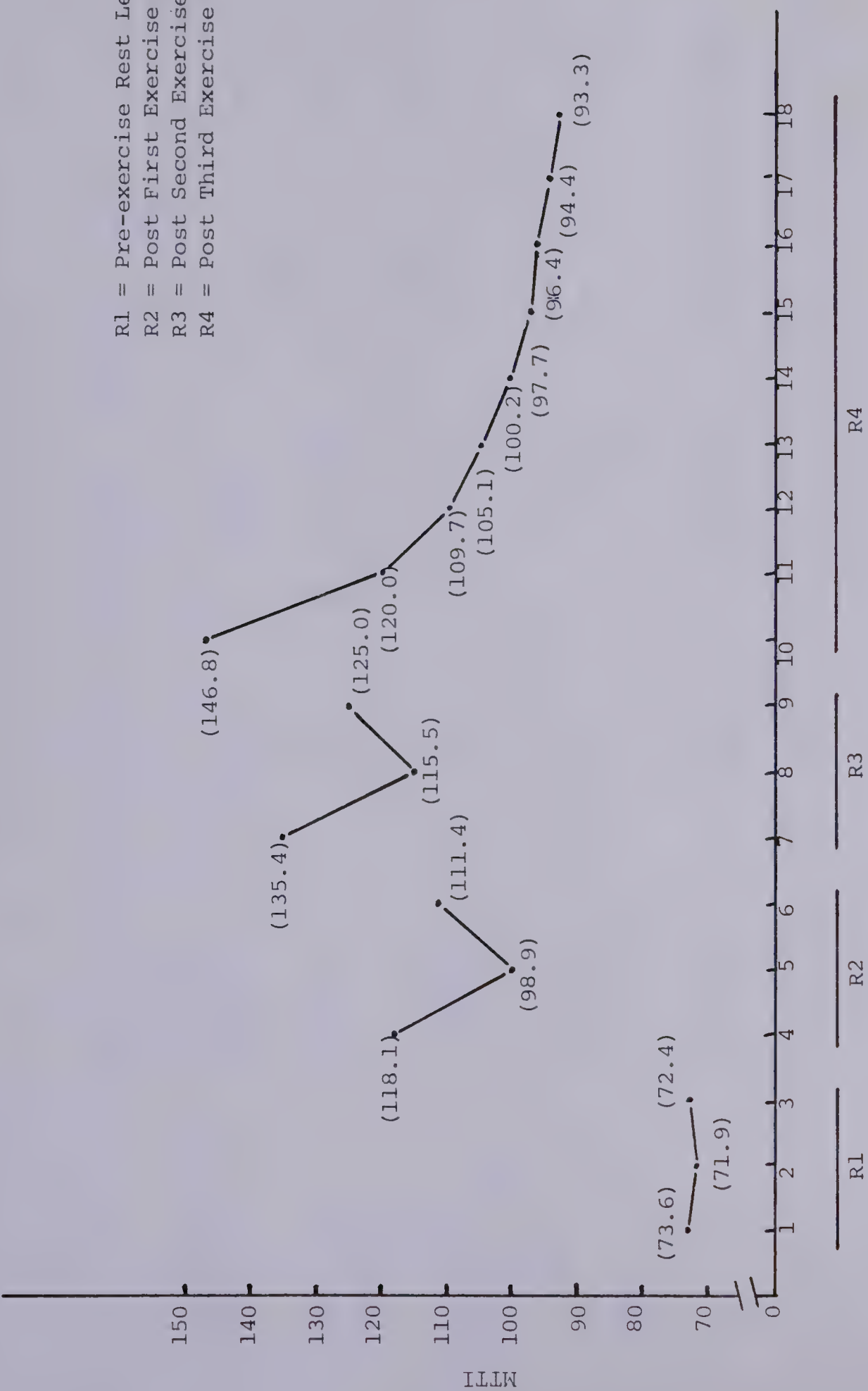
exercise, one rest period of three minutes duration following each of the first two exercise bouts, and three rest periods of three minutes each following the third exercise bout (see Figure 18 as example).

Table XIV shows the values obtained in the one-way analysis of variance for mean blood pressure, modified tension time index, and pulse pressure. Significant differences were found in the modified tension time index and pulse pressure, but not in the mean blood pressure.

A Tukey Test performed on the trials for modified tension time index and pulse pressure showed a significant difference occurred between those trials shown in Table XV.

The results of the Tukey Test on modified tension time index indicated that there were significant differences that occurred between the pre-exercise resting levels and all the post-exercise values. There were also some significant differences between individual values in the post-exercise resting levels. For example, the first value in each of the post-exercise sessions was significantly different from the other.

For pulse pressure, the results of the Tukey Test showed that there were statistically significant differences between the pre-exercise resting levels



R1 = Pre-exercise Rest Level
 R2 = Post First Exercise Bout
 R3 = Post Second Exercise Bout
 R4 = Post Third Exercise Bout

Figure 18: Modified Tension Time Index During Isokinetic Rest Periods

Table XIV

Analysis of Variance for (1) Mean Blood Pressure (2) Modified Tension Time Index, and (3) Pulse Pressure During Isokinetic Rest Periods

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
(1) Mean Blood Pressure	83258.000	71.	1172.648		
TRIALS	6412.500	17.	377.206	1.229	0.233
(2) Modified Tension Time Index	495849.000	71.	6983.785		
TRIALS	519777.000 254545.000	17. 1207.	30575.117 210.891	144.981	0.001
(3) Pulse Pressure	298035.000	71.	4198.379		
TRIALS	358995.375 393995.000	17. 1207.	21117.375 740.675	28.511	0.001

Table XV

Significant Differences Between Trials Using Tukey Test*
for Modified Tension Time Index and Pulse Pressure During
Isokinetic Rest Periods

MODIFIED TENSION TIME INDEX	MODIFIED TENSION TIME INDEX	PULSE PRESSURE
73.622 - 118.101	71.861 - 100.184	37.403 - 68.597
73.622 - 98.937	71.861 - 97.676	37.403 - 66.972
73.622 - 111.398	71.861 - 96.422	37.403 - 39.958
73.622 - 135.379	81.861 - 94.434	37.403 - 71.889
73.622 - 115.495	71.861 - 93.325	37.403 - 96.681
73.622 - 124.967	72.355 - 118.101	37.403 - 72.597
73.622 - 146.796	72.355 - 98.937	36.833 - 63.597
73.622 - 119.953	72.355 - 111.398	36.833 - 66.972
73.622 - 109.665	72.355 - 135.379	36.833 - 39.958
73.622 - 105.149	72.355 - 115.495	36.833 - 71.389
73.622 - 100.184	72.355 - 124.967	36.833 - 64.417
73.622 - 97.676	72.355 - 145.796	36.833 - 96.681
73.622 - 96.422	72.355 - 119.953	36.833 - 72.639
73.622 - 94.434	72.355 - 109.665	37.028 - 63.597
73.622 - 93.325	72.355 - 105.149	37.028 - 66.972
71.861 - 118.101	72.355 - 100.184	37.028 - 89.958
71.361 - 98.937	72.355 - 97.676	37.028 - 71.889
71.361 - 111.398	72.355 - 96.422	37.028 - 96.681
71.361 - 135.379	72.355 - 94.434	37.028 - 72.639
71.861 - 115.495	72.355 - 93.325	68.597 - 96.631
71.361 - 124.967	118.101 - 98.937	66.972 - 96.681
71.361 - 146.796	118.101 - 135.379	60.375 - 39.958
71.861 - 119.953	118.101 - 146.796	60.375 - 96.681
71.861 - 109.665	118.101 - 100.184	89.958 - 62.208
71.361 - 105.149	118.101 - 97.676	89.958 - 57.278
	118.101 - 96.422	
	118.101 - 94.434	
	118.101 - 93.325	
	98.937 - 135.379	

Table XV continued

MODIFIED TENSION TIME INDEX	MODIFIED TENSION TIME INDEX	PULSE PRESSURE
98.937 - 115.495	124.967 - 96.422	89.958 - 53.528
98.937 - 124.967	124.967 - 94.434	89.958 - 50.583
98.937 - 145.796	124.967 - 93.325	89.958 - 48.056
98.937 - 119.953	146.796 - 119.953	89.958 - 45.722
111.393 - 135.379	146.796 - 109.665	89.958 - 44.222
111.398 - 145.796	146.796 - 105.149	64.417 - 96.681
111.398 - 94.434	146.796 - 100.184	96.681 - 62.208
111.398 - 93.325	146.796 - 97.671	96.681 - 57.278
135.379 - 115.495	146.796 - 96.422	96.681 - 53.528
135.379 - 119.053	146.796 - 94.434	96.681 - 50.583
135.379 - 109.665	146.796 - 93.325	96.681 - 48.056
135.379 - 105.149	119.953 - 105.149	96.681 - 45.722
135.379 - 100.184	119.953 - 100.184	96.681 - 44.222
135.379 - 98.676	119.953 - 97.676	72.639 - 44.222
135.379 - 96.422	119.953 - 96.422	
135.379 - 94.434	119.953 - 94.434	
135.379 - 93.325	119.953 - 93.325	
115.495 - 145.796	109.665 - 93.325	
115.495 - 100.184		
115.495 - 97.676		
115.495 - 96.422		
115.495 - 94.434		
115.495 - 93.325		
124.967 - 146.796		
124.967 - 109.665		
124.967 - 105.149		
124.967 - 100.184		
124.967 - 97.676		
	critical value = 14.61 @ $\alpha = .01$	critical value = 27.39 @ $\alpha = .01$

and all immediate post-exercise values. There were also significant differences between individual values in the post-exercise resting levels but there was no obvious pattern in these differences.

The method used for the statistical analysis of the data for heart rate during the isokinetic exercise bouts was a two-way analysis of variance on repeated measures. In the analysis, the terms speed and trials refer to the following: (1) speed - three speeds were chosen for the isokinetic apparatus - 30 degrees per second (slow), 90 degrees per second (medium), and 150 degrees per second (high), and; (2) trials refers to the order in which the selected speed of isokinetic exercise was performed during the isokinetic interval session for that particular test day.

Table XVI shows the values obtained in the two-way analysis of variance for heart rate during isokinetic exercise bouts. Significant differences were found between the different speeds, between the different trials, and significant interaction was found between speed and trials.

The data showed that the primary interaction occurred between the pre-exercise value and the first post-exercise value.

Table XVI
Analysis of Variance for Heart Rate During Isokinetic Exercise Periods

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
	64577.000	23.	2807.696		
SPEED	4491.000	2.	2245.500	13.701	0.001
	7539.000	46.	163.891		
TRIALS	387814.500	3.	129271.500	385.002	0.001
	23168.000	69.	335.768		
SPEED/TRIALS INTERACTION	2391.000	6.	398.500	13.589	0.001
	4047.000	138.	29.326		

A Tukey Test performed on the heart rate of the three exercise bouts showed a significant difference between the first and third exercise trials (critical difference = 12.72).

The method used for the statistical analysis of the data for both systolic and diastolic blood pressure during isokinetic exercise bouts was a two-way analysis of variance on repeated measures. In the analysis, the terms speed and trials refer to the same terms as used in analysis of heart rate data for isokinetic exercise bouts.

Table XVII shows the values obtained in the two-way analysis of variance for systolic blood pressure during isokinetic exercise bouts. Significant differences were found only between the different trials and not between the different speeds.

Table XVIII shows the values obtained in the two-way analysis of variance for diastolic blood pressure during isokinetic exercise. Significant differences were found only between different trials and not between different speeds.

A Tukey Test performed on the trials for systolic and diastolic blood pressure during isokinetic exercise bouts showed that the significant difference

Table XVII
Analysis of Variance for Systolic Blood Pressure During Isokinetic Exercise Bouts

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
	41292.000	23.	1795.304		
SPEED	22.500	2.	11.250	0.044	0.957
	11743.000	46.	255.283		
TRIALS	181329.000	3.	60443.000	402.331	0.001
	10366.000	69.	150.232		
SPEED/TRIALS INTERACTION	460.500	6.	76.750	1.100	0.366
	9629.000	138.	69.775		

Table XVIII
Analysis of Variance for Diastolic Blood Pressure During Isokinetic Exercise Periods

SOURCE:	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
	61934.938	23.	2692.823		
SPEED	822.375	2.	411.188	2.188	0.124
	8644.313	46.	187.920		
TRIALS	83300.625	3.	27766.875	109.479	0.001
	17500.250	69.	253.726		
SPEED/TRIALS INTERACTION	549.094	6.	91.506	2.056	0.062
	6151.500	138.	44.504		

occurred between trial one, which was the mean of the initial rest period, and the three exercise bouts. No significant differences occurred between the three exercise bouts. This difference is illustrated in Figure 19.

The method used for the statistical analysis of the data for mean blood pressure, modified tension time index, and pulse pressure during isokinetic exercise bouts was a one-way analysis of variance on repeated measures. In the analysis, the term trial refers to the order of the different speeds of isokinetic exercise. Trials one to four occurred at thirty degrees per second; trials five to eight occurred at ninety degrees per second, and; trials nine to twelve occurred at 150 degrees per second (see Figure 20 as example). Trials one, five and nine were pre-test rest intervals to enable comparison between resting and exercise levels.

Table XIX shows the values obtained in the one-way analysis of variance for mean blood pressure, modified tension time index, and pulse pressure during isokinetic exercise. Significant differences were found in each test.

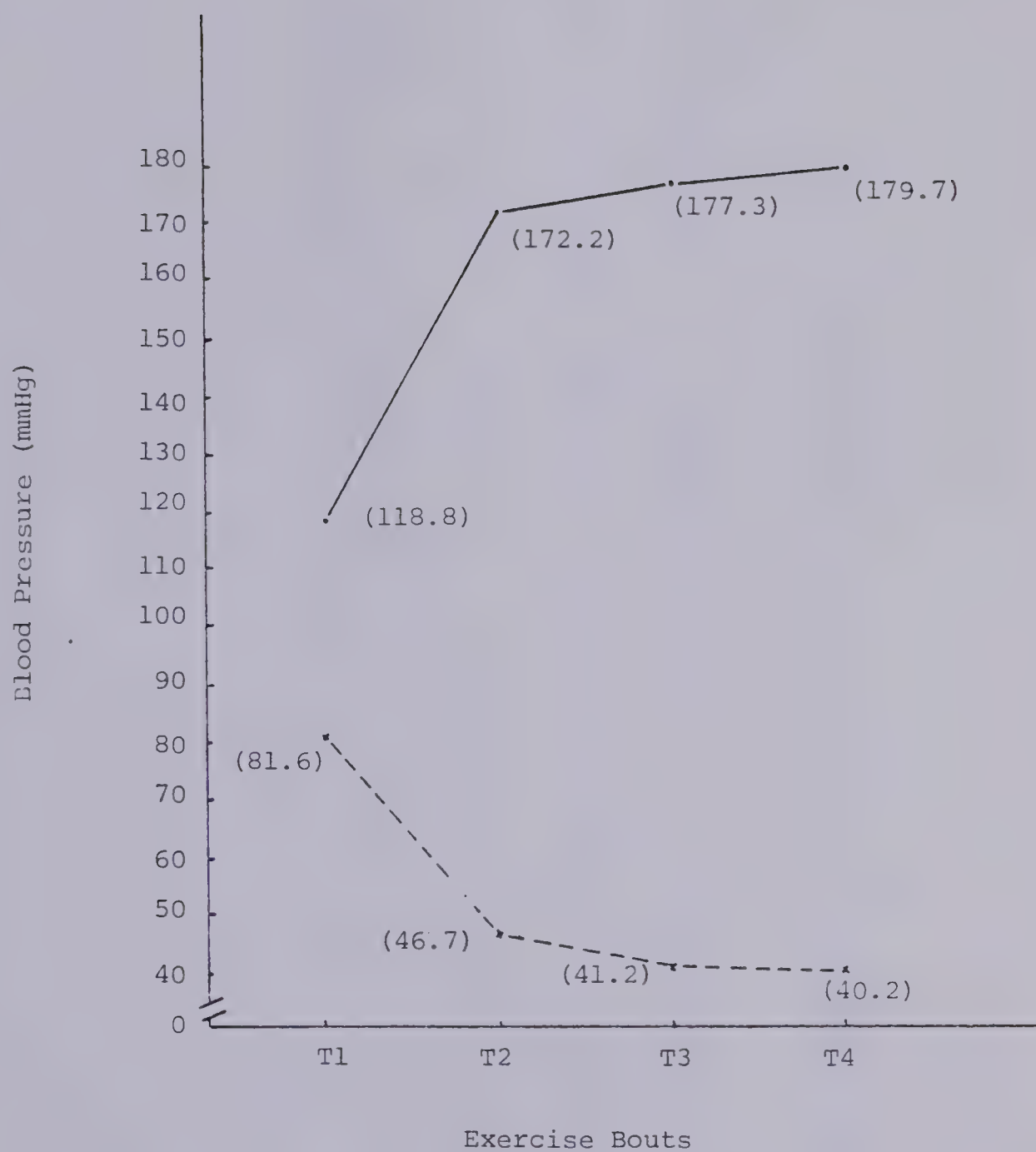
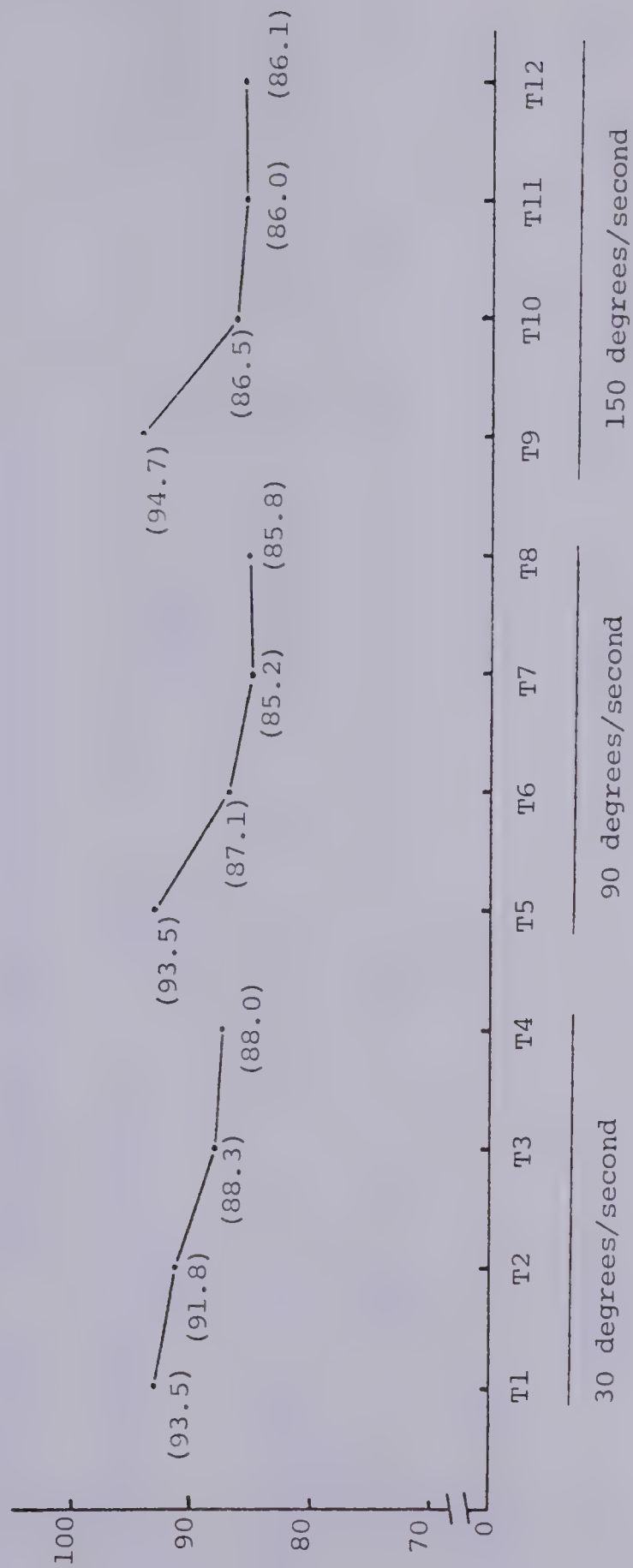


Figure 19: Systolic and Diastolic Blood Pressures During Isokinetic Exercise Bouts. (Note: T1 is Pre-exercise Rest Period)

Mean Blood Pressure (mmHg)



Exercise Bouts

Figure 20: Mean Blood Pressure During Isokinetic Exercise Bouts

Table XIX

Analysis of Variance for (1) Mean Blood Pressure (2) Modified Tension Time Index,
and (3) Pulse Pressure During Isokinetic Exercise Periods

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
(a) Mean Blood Pressure	33324.000	23.	1448.869		
TRIALS	3204.000	11.	291.273	3.965	0.001
	18585.000	253.	73.458		
(b) Modified Tension Time Index	202786.000	23.	8816.781		
TRIALS	1887951.000	11.	171631.875	277.574	0.001
	156437.000	253.	618.328		
(c) Pulse Pressure	97469.000	23.	4237.781		
TRIALS	512283.000	11.	46571.180	194.248	0.001
	60654.000	253.	239.739		

A Tukey Test performed on the trials for mean blood pressure during isokinetic exercise bouts showed that a significant difference occurred only between trial seven and trial nine (see Figure 20).

A Tukey Test performed on the trials for the modified tension time index during isokinetic exercise bouts showed a significant difference occurred between those trials shown in Table XX. This difference is also shown in Figure 21.

The data showed that the statistically significant difference in modified tension time index occurred between the pre-exercise rest level and the three exercise levels for all three speeds of isokinetic exercise tested. There were significant differences between the first isokinetic exercise bout and the last exercise bout for all three speeds. As well, this difference was also evident between the first and the second exercise bouts for the 150 degree per second speed.

A Tukey Test performed on the trials for the pulse pressure during isokinetic exercise bouts showed a significant difference occurred between those trials shown in Table XXI. This difference is also shown in Figure 22.

Table XX

Significant Differences Between Trials Using Tukey Test* for
Modified Tension Time Index During Isokinetic Exercise

TRIAL - TRIAL	TRIAL - TRIAL
74.468 - 224.091	243.578 - 282.822
74.468 - 243.578	257.984 - 73.879
74.468 - 257.984	257.984 - 70.521
74.468 - 242.117	73.879 - 242.117
74.468 - 263.856	73.879 - 263.856
84.468 - 276.780	73.879 - 276.780
74.468 - 244.430	73.879 - 244.430
74.468 - 271.701	73.879 - 271.701
74.468 - 282.822	73.879 - 282.822
224.091 - 257.984	242.117 - 276.780
224.091 - 73.879	242.117 - 70.521
224.091 - 263.856	242.117 - 271.701
224.091 - 276.780	242.117 - 282.822
224.091 - 70.521	263.856 - 70.521
224.091 - 271.701	276.780 - 70.521
224.091 - 282.822	276.780 - 244.430
243.578 - 73.879	70.521 - 244.430
243.578 - 276.780	70.521 - 271.701
243.578 - 70.521	70.521 - 282.822
243.578 - 271.701	244.430 - 271.701
	244.430 - 282.822
*critical value = 26.85 @ α = .01	

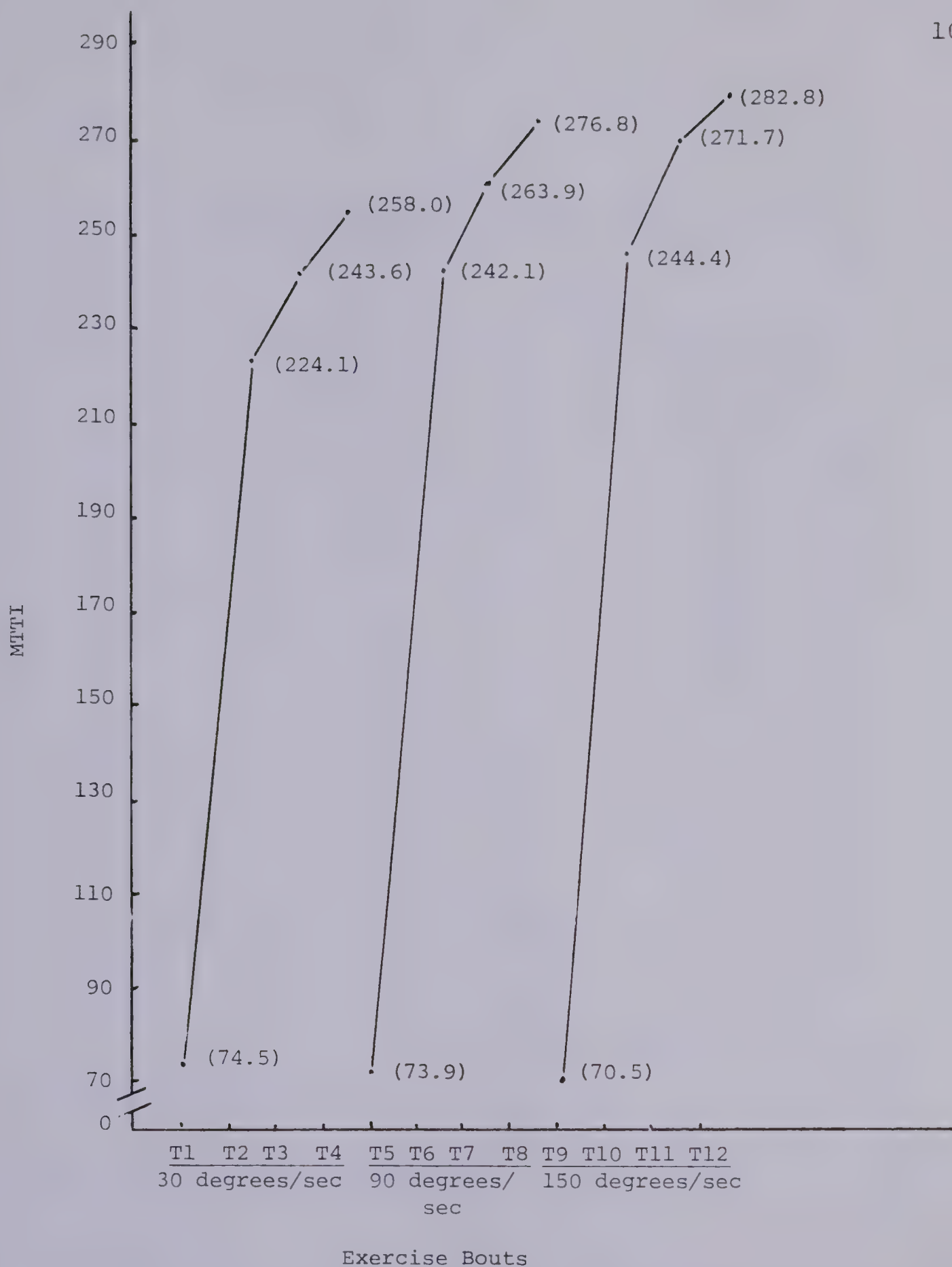


Figure 21: Modified Tension Time Index During Isokinetic Exercise Bouts

Table XXI

Significant Differences Between Trials Using Tukey
Test* for Pulse Pressure During Isokinetic Exercise

TRIAL - TRIAL	TRIAL - TRIAL
38.292 - 123.417	134.250 - 37.708
38.292 - 131.167	134.250 - 35.542
38.292 - 134.250	37.708 - 125.542
38.292 - 125.542	37.708 - 137.500
38.292 - 137.500	37.708 - 142.208
38.292 - 142.208	37.708 - 126.875
38.292 - 126.875	37.708 - 139.583
38.292 - 139.583	37.708 - 141.792
38.292 - 141.792	125.542 - 35.542
123.917 - 37.708	137.500 - 35.542
123.917 - 142.408	142.208 - 35.542
123.917 - 35.542	35.542 - 126.875
123.917 - 141.792	35.542 - 139.583
131.167 - 37.708	35.542 - 141.792
131.167 - 35.542	
*critical value = 16.72 @ $\alpha = .01$	

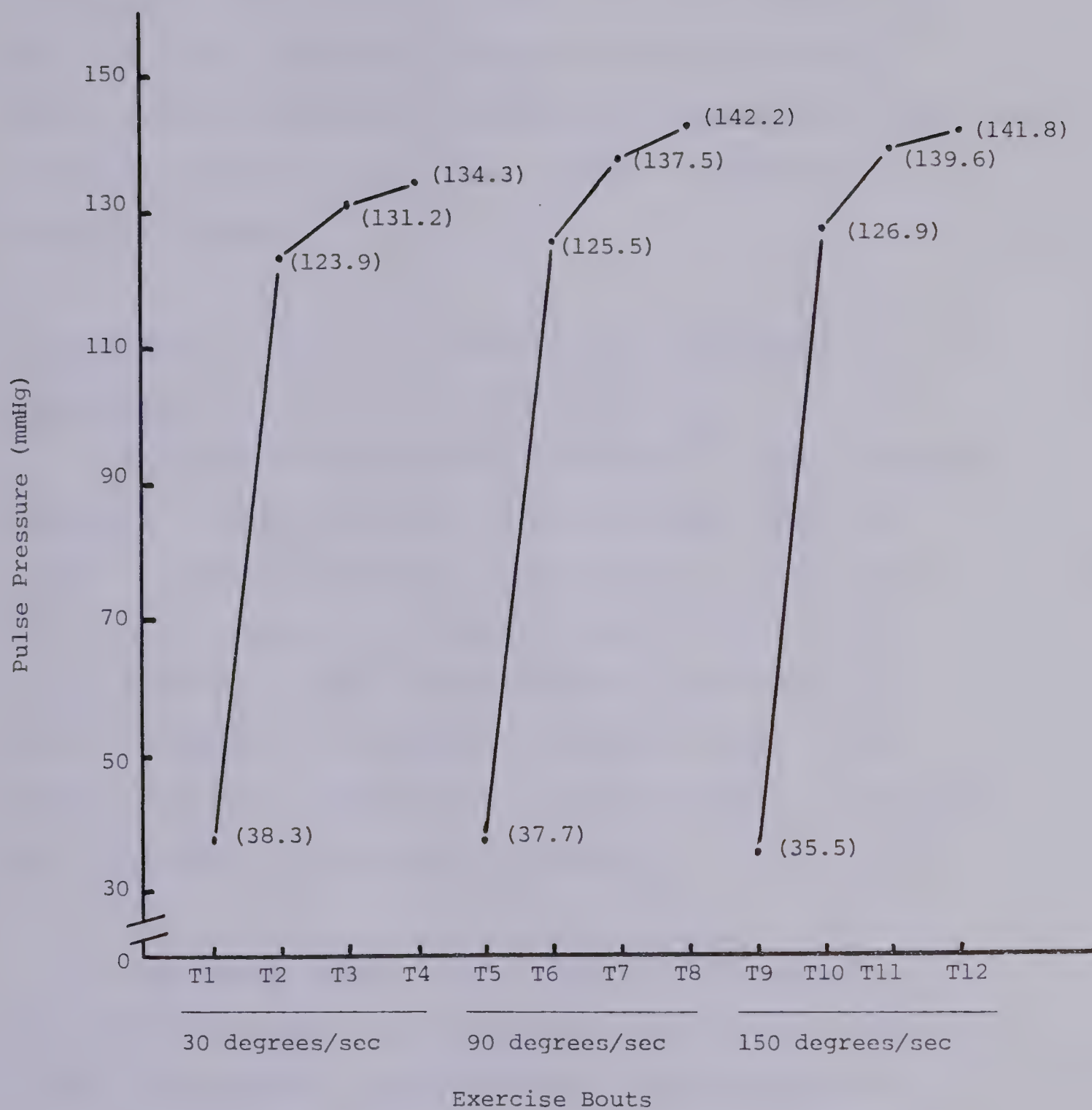


Figure 22: Pulse Pressure During Isokinetic Exercise Bouts

The data showed that there was a statistically significant difference in pulse pressure between the pre-exercise rest level and the three exercise levels for all three speeds of isokinetic exercise tested. There was no significant differences between the three exercise levels for all three speeds of isokinetic exercise tested.

Comparison of Effect of Isometric and Isokinetic Exercise on Heart Rate and Blood Pressure

In comparing the effect of isometric and isokinetic exercise on heart rate and blood pressure, only the effect of maximum voluntary contraction on heart rate and blood pressure for isometric exercise and the first isokinetic exercise bout were considered. As well, the mean blood pressure modified tension time index, and pulse pressure for maximum isometric exercise and isokinetic exercise were analyzed.

The method used for the statistical analysis of the data for heart rate during maximum isometric exercise and isokinetic exercise was a one-way analysis of variance. In the analysis, the term comheart refers to the heart rate during isokinetic exercise at thirty, ninety and 150 degrees per second, and during

maximum voluntary contraction of isometric exercise. Heart 1, 2, and 3 refer to the heart rate during isokinetic exercise at thirty degrees per second, ninety degrees per second, and 150 degrees per second, respectively. Heart 3 and 4 refer to the heart rate during maximum voluntary isometric contraction using quadriceps and hamstring muscle groups respectively.

Table XXII shows the values obtained in the one-way analysis of variance for comparison of heart rate during isometric and isokinetic exercise. The difference of the means is illustrated in Figure 23. A Scheffe Test performed on the means of the heart rate during isometric and isokinetic exercise showed that a significant difference occurred between those means shown in Table XXIII.

The data indicated there was a significant difference in heart rates between the isokinetic exercise and the isometric exercise. As well, the slow speed (thirty degrees per second) values was significantly different than the other two speeds of isokinetic exercise. Isometric quadriceps muscle group data for heart rate was also statistically different from the isometric hamstring muscle group data.

The method used for the statistical analysis of the data for systolic blood pressure during maximum isometric exercise and isokinetic exercise was a one-

Table XXII
Analysis of Variance for Comparison of Heart Rates During Isokinetic and
Maximum (Isometric) Exercise

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROBABILITY
BETWEEN GROUPS	4	15073.7028	3768.4255	8.867	0.0000
WITHIN GROUPS	115	48872.9453	424.9819		
TOTAL	119	63946.6445			

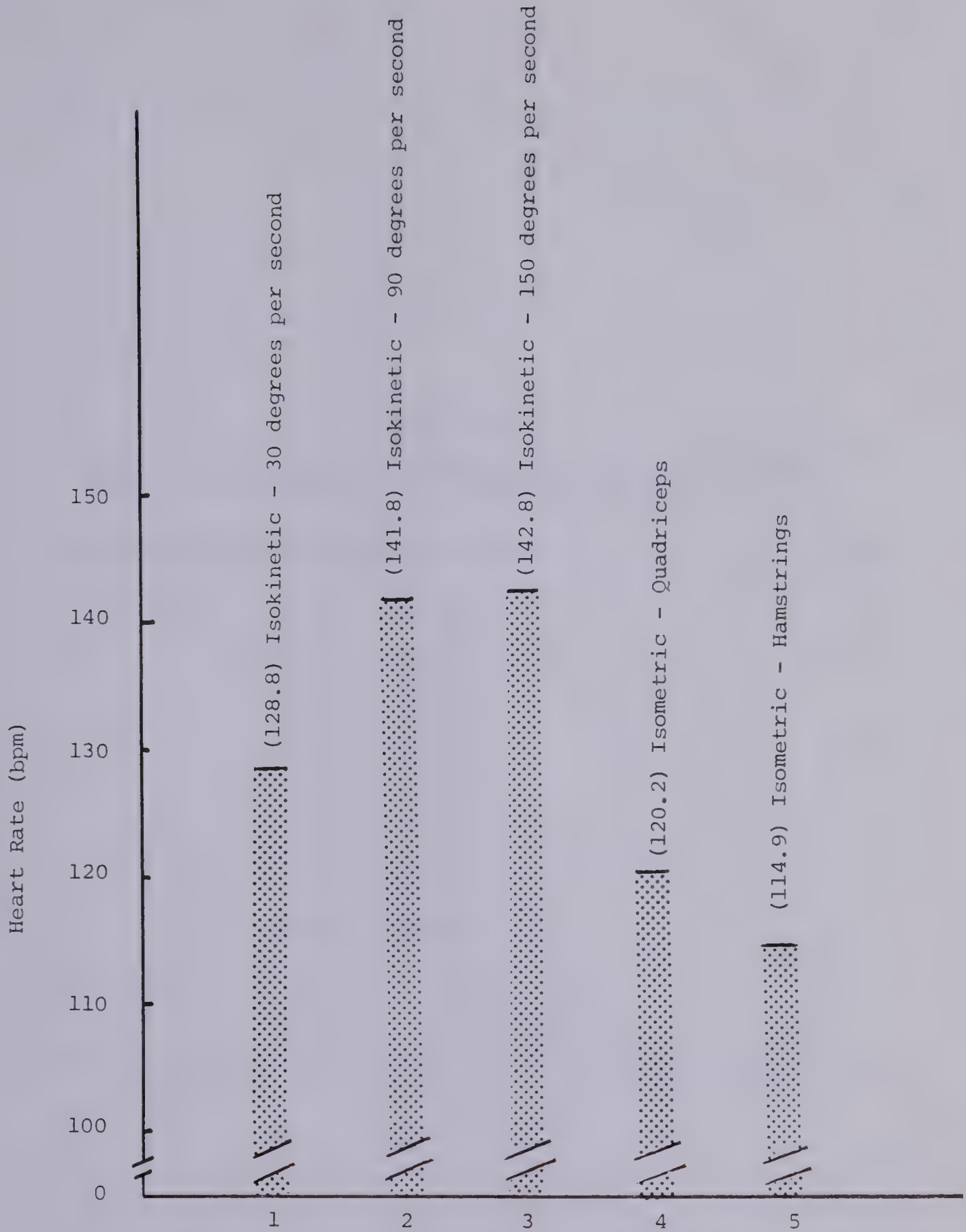


Figure 23: Maximum Heart Rate During Isokinetic and Isometric Exercise

Table XXIII

Significant Differences Between Heart Rates Using Scheffe
Test* During Isokinetic and Isometric Exercise

128.792 - 141.833
128.792 - 142.792
128.792 - 120.208
128.792 - 114.917
141.833 - 120.208
141.833 - 114.917
142.792 - 120.208
142.792 - 114.417
120.208 - 114.917

*critical value = 4.43 @ $\alpha = .05$

way analysis of variance. In the analysis, the term comsystolic refers to the systolic blood pressure during isokinetic and isometric exercise. Systol 1, 2, and 3 refer to the systolic blood pressure during isokinetic exercise at thirty degrees per second, ninety degrees per second, and 150 degrees per second respectively. Systol 4 and 5 refer to the systolic blood pressure during maximum voluntary isometric contraction using quadriceps and hamstring muscle groups respectively.

Table XXIV shows the values obtained in the one-way analysis of variance for comparison of systolic blood pressure during isometric and isokinetic exercise. The difference of the means is illustrated in Figure 24.

A Scheffe Test performed on the means of the systolic blood pressure during isometric and isokinetic exercise showed that a significant difference occurred between those means shown in Table XXV.

The data for systolic blood pressure showed a statistically significant difference between isokinetic exercise and isometric exercise. There were no significant differences between the different speeds of isokinetic exercise, or between the two muscle groups performing isometric exercise.

Table XXIV

Analysis of Variance for Comparison of (1) Systolic Blood Pressure and (2) Diastolic Blood Pressure During Isokinetic and Maximum Isometric Exercise

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROBABILITY
(1) Systolic Blood Pressure					
BETWEEN GROUPS	4	4200.2823	1050.0706	3.395	0.115
WITHIN GROUPS	115	35573.5039	309.3347		
TOTAL	119	39773.7852			

(2) Diastolic Blood Pressure					
BETWEEN GROUPS	4	136304.1758	34076.0430	120.968	0.0000
WITHIN GROUPS	115	32394.9429	281.6951		
TOTAL	119	168699.0625			

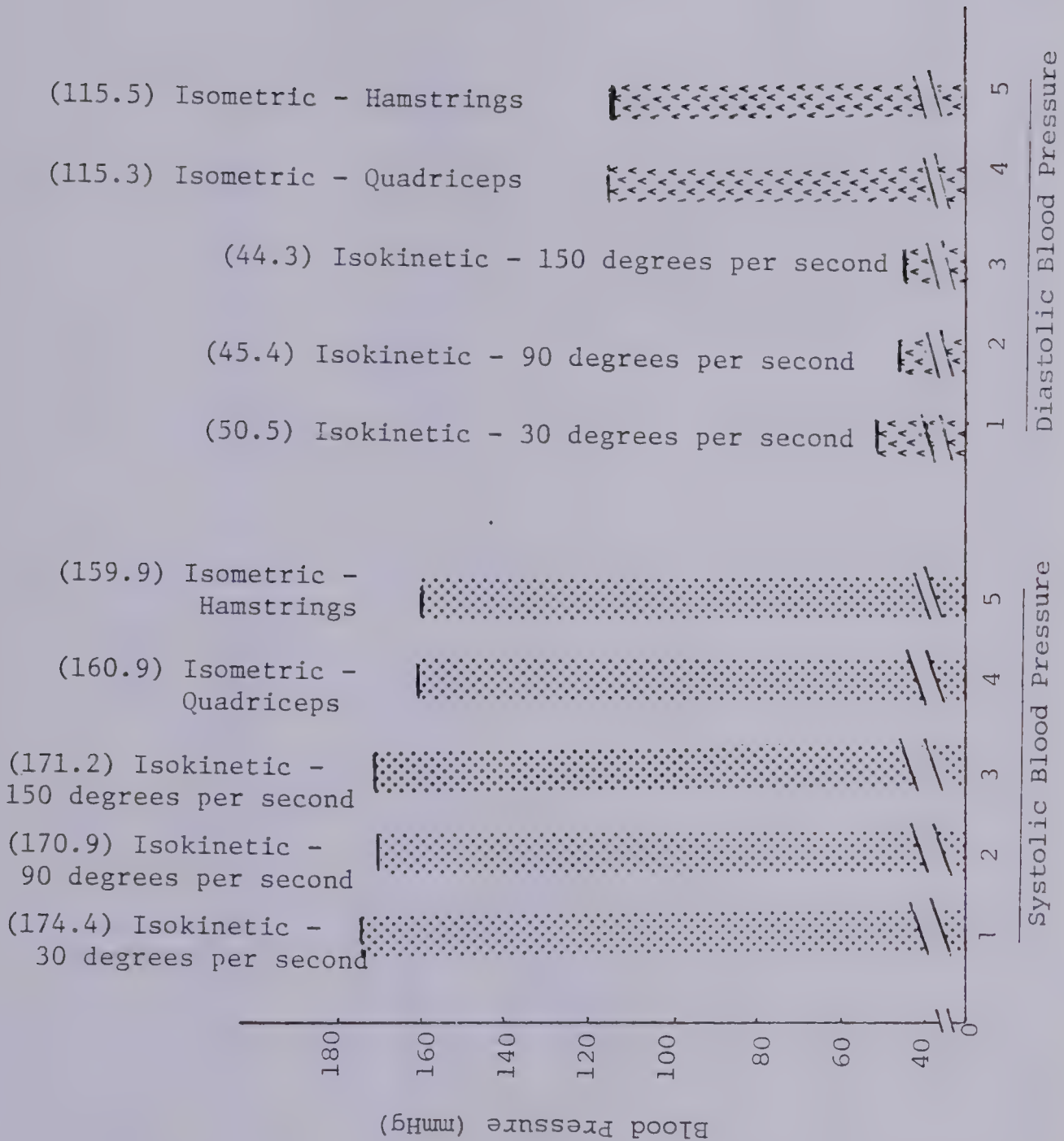


Figure 24: Maximum Systolic and Diastolic Blood Pressure During Isokinetic and Maximum Isometric Exercise

Table XXV

Significant Differences Between Means Using Scheffe Test*
for (1) Systolic Blood Pressure and (2) Diastolic Blood Pressure
During Isokinetic and Isometric Exercise

(1) SYSTOLIC BLOOD PRESSURE	(2) DIASTOLIC BLOOD PRESSURE
174.5 - 160.9	50.5 - 45.4
174.5 - 159.9	50.5 - 44.3
171.2 - 160.9	50.5 - 115.3
171.2 - 159.9	50.5 - 115.5
170.9 - 160.9	45.4 - 115.3
170.9 - 159.9	45.4 - 115.5
	44.3 - 115.3
	44.3 - 115.5
*critical value = 4.43 @ $\alpha = .05$	*critical value = 4.43 @ $\alpha = .05$

The method used for the statistical analysis of the data for diastolic blood pressure during maximum isometric exercise and isokinetic exercise was a one-way analysis of variance. In the analysis, the term comdiastolic refers to the diastolic blood pressure during isokinetic and isometric exercise. Diastol 1, 2, and 3 refer to the diastolic blood pressure during isokinetic exercise at thirty degrees per second, ninety degrees per second and 150 degrees per second, respectively. Diastol 4 and 5 refer to the diastolic blood pressure during maximum voluntary isometric contraction using quadriceps and hamstring muscle groups respectively.

Table XXIV shows the values obtained in the one-way analysis of variance for comparison of diastolic blood pressure during isometric and isokinetic exercise, The differences of the means is illustrated in Figure 24.

A Scheffe Test performed on the means of the diastolic blood pressure during isometric and isokinetic exercise showed that a significant difference occurred between those means shown in Table XXV.

For diastolic blood pressure, there was a statistically significant difference between the values for isometric exercise and isokinetic exercise. There

was no statistically significant difference between the two muscle groups performing isometric exercise. However, the difference was statistically significant between the slow isokinetic speed (thirty degrees per second) and the two faster isokinetic speeds.

The method used for the statistical analysis of the data for mean blood pressure during maximum isometric exercise and isokinetic exercise was a one-way analysis of variance. In the analysis, the term COMMBP refers to the mean blood pressure during isokinetic and isometric exercise. MBP1, 2, and 3 refer to the mean blood pressure during isokinetic exercise at thirty degrees per second, ninety degrees per second, and 150 degrees per second respectively. MBP4 and 5 refer to the mean blood pressure during maximum voluntary isometric contraction using quadriceps and hamstring muscle groups respectively.

Table XXVI shows the values obtained in the one-way analysis of variance for comparison of mean blood pressure during isokinetic and isometric exercise. The difference of the means is illustrated in Figure 25.

A Scheffe Test performed on the means of the mean blood pressure during isokinetic and isometric exercise showed that a significant difference occurred between those means shown in Table XXVII.

Table XXVI
Analysis of Variance for Comparison of Mean Blood Pressure During Isokinetic and
Maximum Isometric Exercise

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROBABILITY
BETWEEN GROUPS	4	50723.4418	12680.8594	70.702	0.0000
WITHIN GROUPS	115	20626.0930	179.3573		
TOTAL	119	71349.5000			

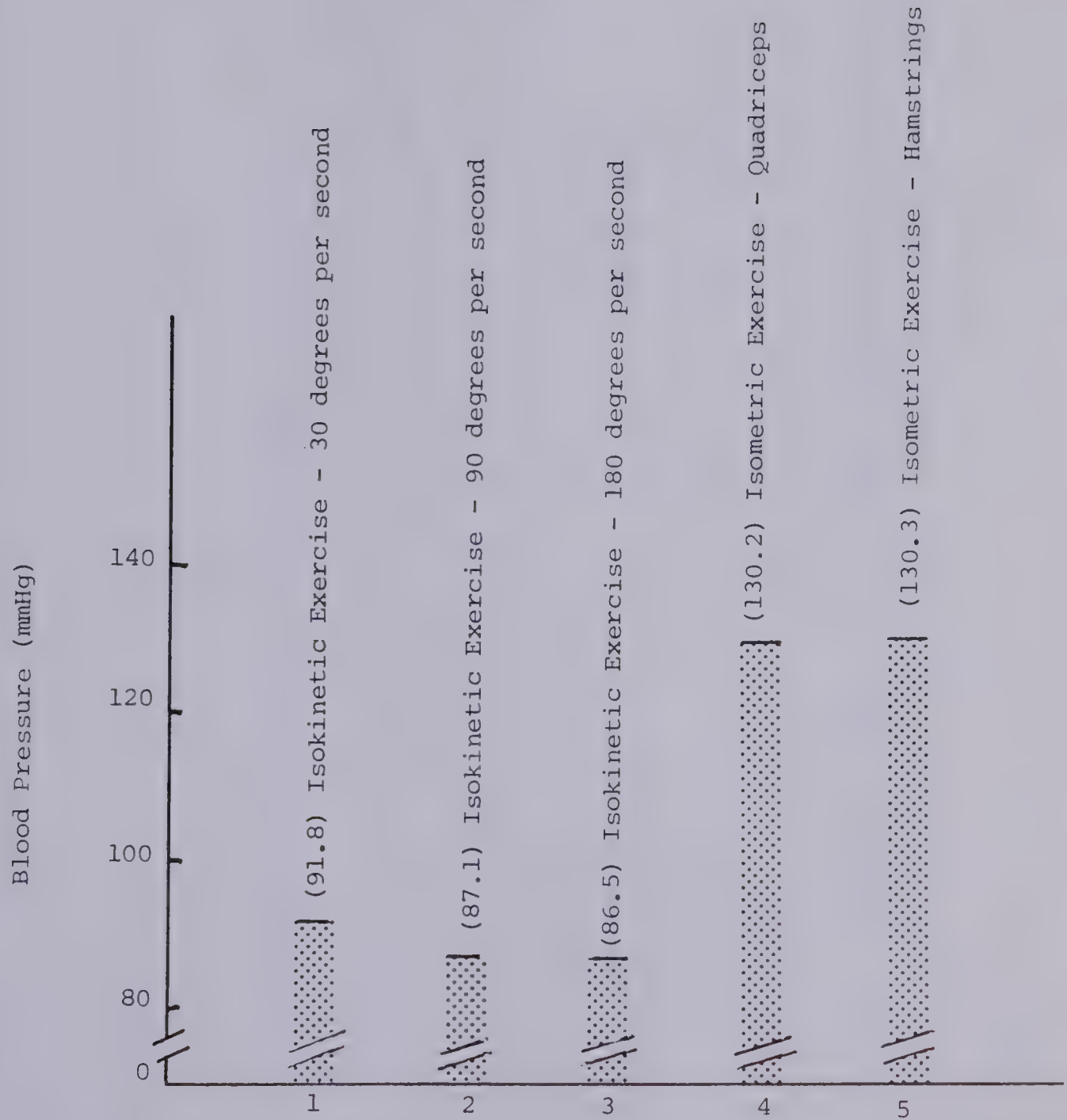


Figure 25: Mean Blood Pressure During Isokinetic and Maximum Isometric Exercise

Table XXVII

Significant Differences Between Means Using Scheffe Test*
for Mean Blood Pressure During Isokinetic and Maximum Isometric Exercise

TRIAL - TRIAL	TRIAL - TRIAL
91.8 - 87.1	87.1 - 130.2
91.8 - 86.5	87.1 - 130.3
91.8 - 130.2	86.5 - 130.2
91.8 - 130.3	86.5 - 130.3
*critical value = 4.43 @ α = .05	

The data for mean blood pressure showed that statistically significant differences occurred between the mean blood pressure values for isokinetic exercise and isometric exercise. As well, there was a statistically significant difference in mean blood pressure between the slow (thirty degrees per second) isokinetic speed and the two faster isokinetic speeds. There was no significant difference between the two muscle groups tested isometrically.

The method used for the statistical analysis of the data for modified tension time index during maximum isometric exercise and isokinetic exercise was a one-way analysis of variance. In the analysis, the term COMMTTI refers to the modified tension time index during isokinetic and isometric exercise. MTTI1, 2 and 3 refer to the modified tension time index during isokinetic exercise at thirty degrees per second, ninety degrees per second, and 150 degrees per second respectively. MTTI4 and 5 refer to the modified tension time index during maximum voluntary isometric contraction using quadriceps and hamstring muscle groups respectively.

Table XXVIII shows the values obtained in the one-

Table XXVIII
Analysis of Variance for Comparison of Modified Tension Time Index During
Isokinetic and Maximum Isometric Exercise

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROBABILITY
BETWEEN GROUPS	4	73074.5809	18268.6445	11.357	0.0000
WITHIN GROUPS	115	183994.4023	1608.6470		
TOTAL	119	258068.9375			

way analysis of variance for comparison of modified tension time index during isometric and isokinetic exercise. The difference of the means is illustrated in Figure 26.

A Scheffe Test performed on the modified tension time index during isometric and isokinetic exercise showed that a significant difference occurred between those means shown in Table XXIX.

The data for modified tension time index showed that statistically significant differences in the index occurred between isokinetic exercise and isometric exercise. As well, significant differences in the index occurred between the slow (thirty degrees per second) isokinetic speed and the two faster isokinetic speeds. There were significant differences in the index between the values obtained for the quadriceps muscle group and the hamstring muscle group during isometric exercise.

The method used for the statistical analysis of the data for pulse pressure during maximum isometric exercise and isokinetic exercise was a one-way analysis of variance. In the analysis, the term COMPP refers to the pulse pressure during isokinetic and isometric exercise. PP1, 2, and 3 refer to the pulse pressure

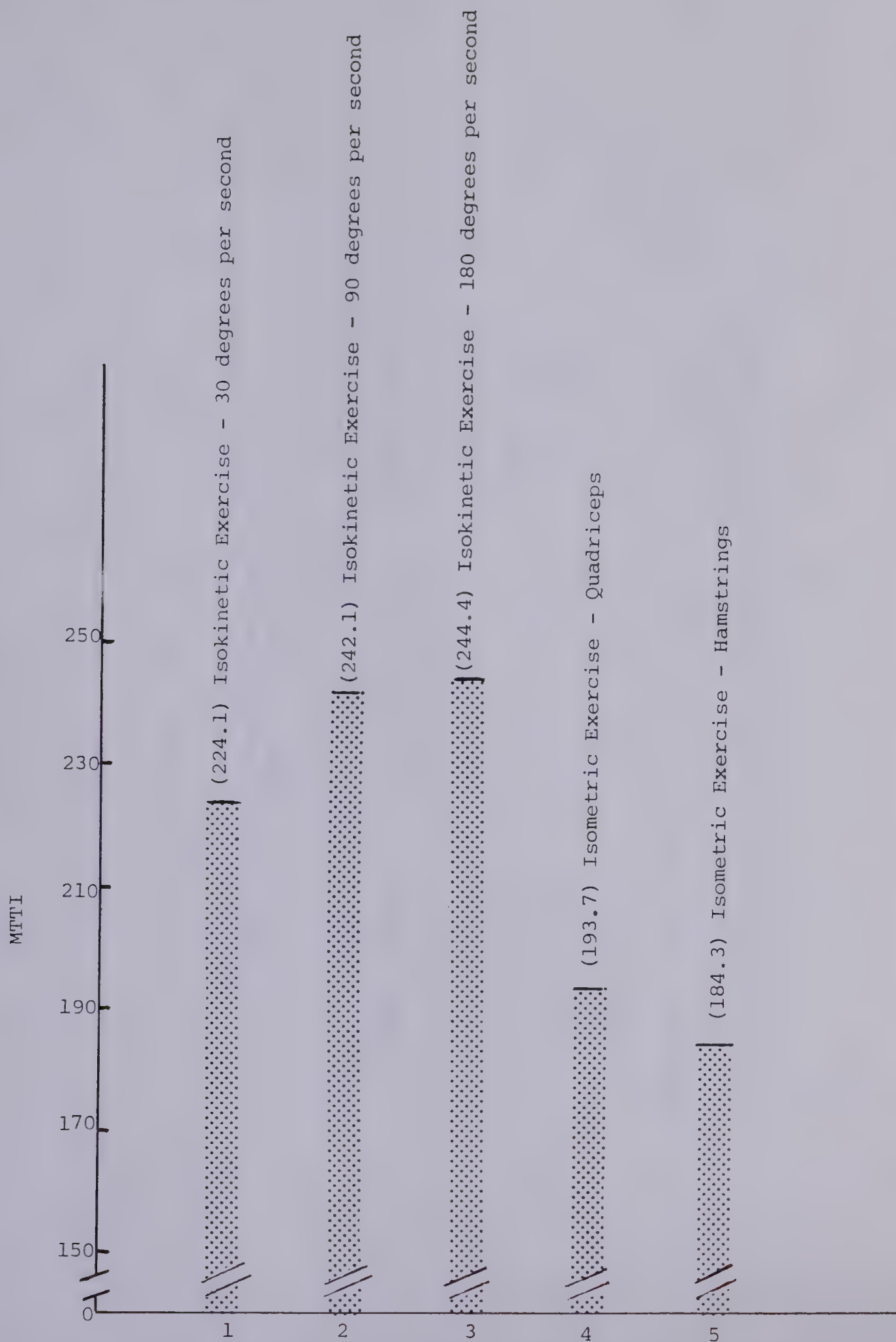


Figure 26: Modified Tension Time Index During Isokinetic and Maximum Isometric Exercise

Table XXIX
Significant Differences Between Means Using Scheffe
Test* for Modified Tension Time Index During Iso-
kinetic and Maximum Isometric Exercise

TRIAL - TRIAL	TRIAL - TRIAL
224.1 - 242.1	242.1 - 184.3
224.1 - 244.4	244.4 - 193.7
224.1 - 193.7	244.4 - 184.3
224.1 - 184.3	193.7 - 184.3
242.1 - 193.7	
*critical value = 4.43 @ $\alpha = .05$	

during isokinetic exercise at thirty degrees per second respectively. PP4 and 5 refer to the pulse pressure during maximum voluntary isometric contraction using quadriceps and hamstrings respectively.

Table XXX shows the values obtained in the one-way analysis of variance for comparison of pulse pressure during isometric and isokinetic exercise. The difference between the means is illustrated in Figure 27.

A Scheffe Test performed on the means of the pulse pressure during isometric and isokinetic exercise showed that a significant difference occurred between those means shown in Table XXXI. The data showed that statistically significant differences in pulse pressure occurred between isokinetic exercise and isometric exercise. There were no significant differences in pulse pressure between the three speeds of isokinetic exercise tested, nor between the two muscle groups tested isometrically.

Table XXX

Analysis of Variance for Comparison of Pulse Pressure During Isokinetic
and Maximum Isometric Exercise

SOURCE	D.F.	SUM OF SQUARES	MEAN SQUARES	F RATIO	F PROBABILITY
BETWEEN GROUPS	4	186500.3514	46625.0859	93.177	0.0000
WITHIN GROUPS	115	57544.9792	500.3911		
TOTAL	119	244045.3125			

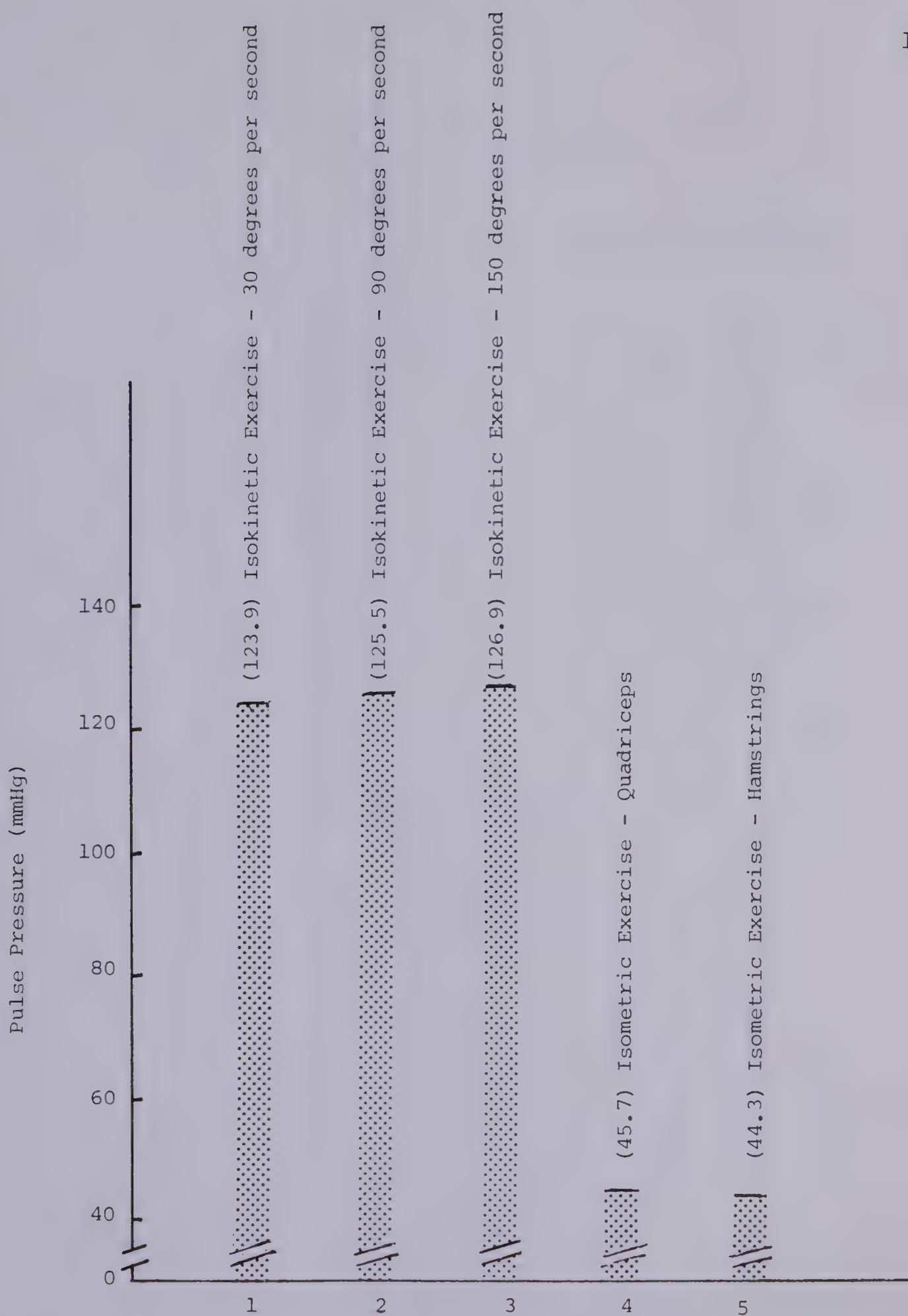


Figure 27: Pulse Pressure During Isokinetic and Maximum Isometric Exercise

Table XXXI
Significant Differences Between Means Using Scheffe
Test* for Pulse Pressure During Isokinetic and Maximum Iso-
metric Exercise

123.9 - 44.3
123.9 - 45.7
125.5 - 44.3
125.5 - 45.7
126.9 - 44.3
126.9 - 45.7
*critical value = 4.43 @ α = .05

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CHAPTER V

DISCUSSION

The purpose of the study was to determine the effect of isokinetic exercise on heart rate and blood pressure at three different speeds of movement and to determine if an isokinetic interval program had a cumulative effect on heart rate and blood pressure. In addition, the effect of isometric exercise, using quadriceps and hamstrings muscle groups, was performed to compare with the results found by previous authors. The results of the isometric and isokinetic exercises were then compared.

Effect of Isometric Exercise on Heart Rate and Blood Pressure

In both the quadriceps and hamstrings muscle groups tests, there was a statistically significant difference between trials for heart rate and a statistically significant difference in the groups/trials interaction for heart rate during the isometric rest periods. Although the interaction occurred between each of the groups, there was no definite pattern and the primary interaction was between the post-test values. These differences are due to two factors. First, following

each bout of exercise, the heart rate took several minutes to return to resting or near resting levels. Secondly, for each pre-test rest period, the subjects were told that they had one minute until they had to perform an isometric test. This information to the subject caused, in most cases, an increase in heart rate prior to the exercise due to anticipation on the part of the subject.

In the quadriceps and hamstring muscle groups, there was a statistically significant difference between the trials for systolic blood pressure and a statistically significant difference in the groups/trials interaction for systolic blood pressure during isometric rest periods. The differences shown were primarily between the pre-trial values and the post-trial values. Although the values obtained were statistically significant, they were not clinically important as they were within normal resting norms.

During the isometric rest periods, there was a statistically significant difference between the trials for mean blood pressure, modified tension time index and pulse pressure for both quadriceps and hamstring muscle groups. Again, although the values obtained were statistically significant, they were clinically unimportant. It was interesting to note, as was seen in

Figures 11, 12, and 13, that the values obtained for quadriceps muscle group were consistently higher than those obtained for the hamstrings muscle group. These differences may be due to the different size of the two muscle groups (1).

Both the quadriceps and hamstring muscle groups showed a statistically significant difference in heart rate during the isometric exercise bouts for the different percentages of muscle contraction. The increases shown were the result of the withdrawal of the vagal influence on the heart as well as hormonal influences and were consistent with the results reported by other authors (2,3,4,5,6,7,8,9,10).

During the isometric exercise bouts, both the quadriceps and hamstring muscle groups showed a statistically significant difference in systolic and diastolic blood pressure for the different percentages of muscle contraction. The increases shown were the result of increases in heart rate and consequently cardiac output.

The cardiac output was increased by the body in an attempt to overcome the constriction of the blood vessels and occlusion of the muscle vascular bed caused by the isometric contraction (3,4,5,6,7,8,9,10).

For the different percentages of muscle contrac-

tion during isometric exercise bouts, both the quadriceps and hamstring muscle groups showed a statistically significant difference in mean blood pressure, and modified tension time index for both muscle groups. A statistically significant difference in pulse pressure was also found for the hamstring muscle groups.

The mean blood pressure is an indication of the driving force required to drive the blood through the circulatory system. As the data indicated (Figure 16), the driving force required to push the blood through the circulatory system increased as the percentage of maximum voluntary contraction increased. This increase in driving force was necessary to overcome the constriction of the blood vessels and restriction of the muscle vascular bed caused by the isometric contraction (4,10).

The modified tension time index gives an indication of the oxygen consumption of the heart during exercise (11,12,13). As the data indicated (Figure 17), oxygen consumption probably increased as the percentage of maximum voluntary contraction increased. This increase was necessary to supply more oxygen to the heart when the heart was performing a higher level of activity (12, 13,14).

The pulse pressure is the difference between the systolic and diastolic blood pressure. The pulse pressure value which is normally about 40 mmHg can be increased by increased stroke volume (increase in systolic pressure and decrease in diastolic pressure) or by decreasing the capacitance of the arterial tree (15). Although the values obtained for pulse pressure were statistically significant for the hamstring muscle group, they were clinically unimportant as they fell within expected resting values.

Effect of Isokinetic Exercise on Heart Rate and Blood Pressure

During the isokinetic rest periods, there were statistically significant differences in heart rate between the three speeds of isokinetic exercise (thirty degrees per second, ninety degrees per second, and 150 degrees per second), between the rest periods, and between the trials. As well, there were statistically significant differences between the interactions of speed and rest, and rest and trials. The significant interaction between speed and rest occurred primarily between the initial rest period and the first post-exercise period. There was also an interaction between the first and second post-exercise rest periods for the medium and high speeds. The significant inter-

action between rest and trials occurred between the pre-exercise rest period and the first post-exercise rest period. There was also interaction between the second and third post-exercise periods. The changes that occurred were due to the heart rates not returning to the pre-test resting levels and the subjects were told that they had fifteen seconds to exercise. The heart rate was recorded just prior to exercise. Although the values were statistically significant they fell within expected resting heart rates and therefore, were clinically unimportant.

There were statistically significant differences in systolic blood pressure between the three speeds of isokinetic exercise, between the rest periods, and between the trials. As well, there were statistically significant differences between the interactions of speed and rest, and rest and trials. The significant interaction between speed and rest occurred primarily between the initial rest period and the first post-exercise period. The significant interaction between rest and trials occurred between the same two periods, namely, the pre-exercise period and the first post-exercise period. There were no statistically significant differences between any of the variables when looking at diastolic blood pressure. The differences

shown were primarily between the pre-trial values and the immediate post-trial values. The post-trial values at the end of the exercise session showed the blood pressure returning to near resting levels. The results do indicate that systolic pressure remains elevated during an isokinetic interval program. These values are slightly above the range one would consider normal for resting systolic blood pressures. Figure 25 also shows a drop in diastolic blood pressure during an isokinetic interval program. The differences were not statistically significant and do fall within the range one would consider normal for resting diastolic blood pressure.

Statistically significant differences during isokinetic rest periods were found for modified tension time index and pulse pressure. No significant differences were found in mean blood pressure. The values obtained show statistical significance but clinically they are unimportant as they fall within normal resting values.

During the isokinetic exercise bouts, there were statistically significant differences in heart rate between the three speeds of isokinetic exercise (thirty degrees per second, ninety degrees per second, and 150 degrees per second), between the trials, and

between the speed/trial interactions. The increases were probably due to the removal of the vagal influence on the heart and the action of hormones as was seen in isometric exercise. The continuing and increased demand for oxygen by the tissues, and the need to remove metabolites and heat would also be a factor. The heart rate increased between trials. The increased heart rate over trials is illustrated in Figure 28.

There were statistically significant differences in systolic and diastolic blood pressure between trials (Figure 19). The systolic blood pressure increased between trials and the diastolic blood pressure decreased between trials. The significant difference in blood pressure occurred between the first trial which was the pre-exercise rest period and the three exercise bouts. There was no significant difference in blood pressure between the exercise bouts. This difference was illustrated in Figure 19. The increase in systolic pressure during isokinetic exercise was due to the body's attempt to overcome the occlusion of the vascular beds within the muscle. The decrease in diastolic pressure may have been due to relaxation of one muscle group while the other muscle group contracted.

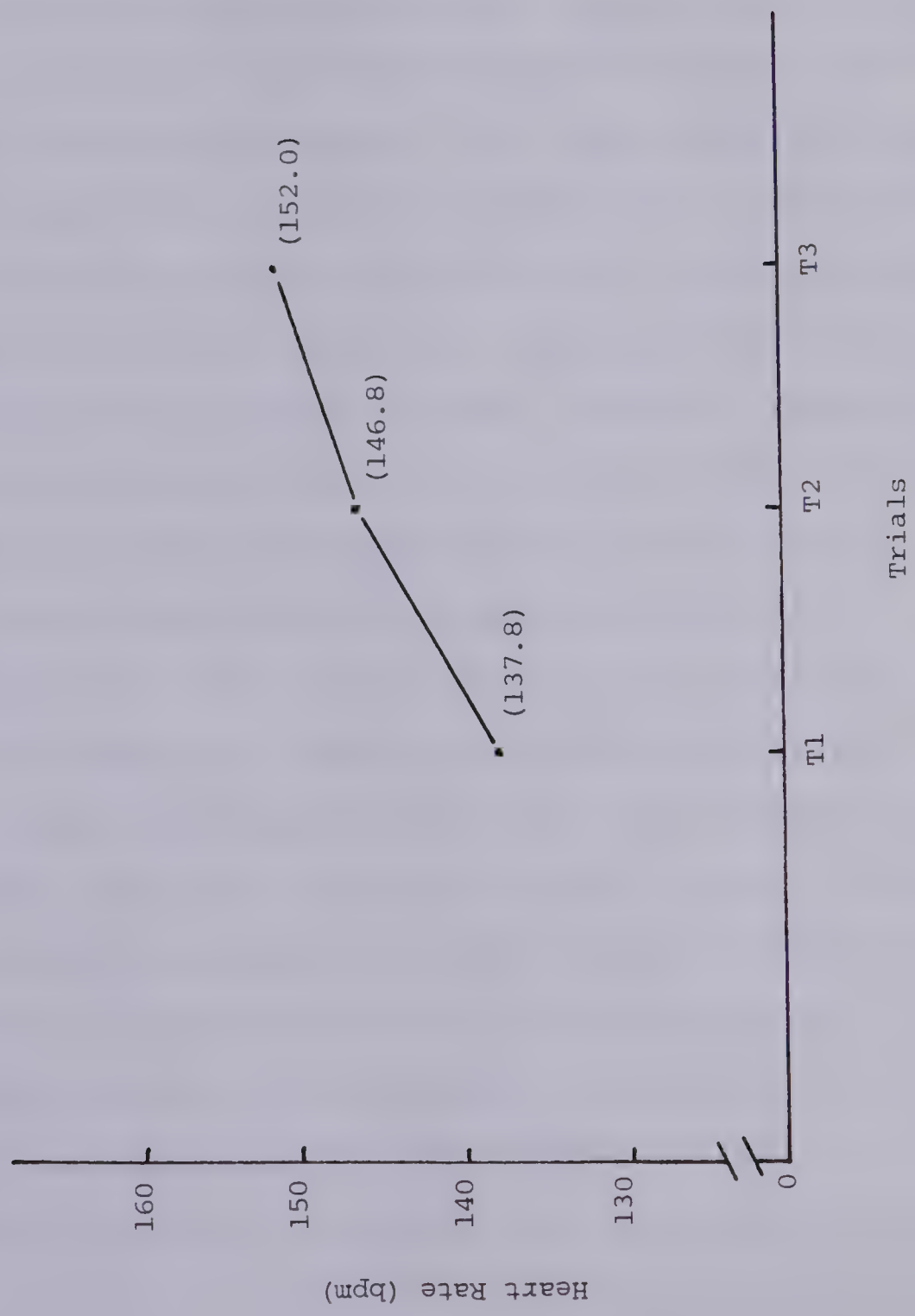


Figure 28: Increase in Heart Rate During Isokinetic Interval Exercise

The modified tension time index gives an indication of the oxygen consumption of the heart during exercise (11,12,13). As the data indicated (Figure 21 and Table 20), oxygen consumption increased with isokinetic exercise. The largest statistical difference did occur between the pre-test rest levels and the exercise levels. Trials two to four indicate isokinetic exercise at thirty degrees per second. The significant difference at this speed occurred between trial two and four indicating that with an isokinetic interval program, oxygen consumption increases with each interval of exercise.

Trials six to eight indicate isokinetic exercise at ninety degrees per second. The significant difference at this speed occurred between trial six and trial eight indicating again that oxygen consumption increases with each interval of exercise. There is also a statistically significant difference between trial two and trials seven and eight, and between trial three and trial eight indicating that as speeds of isokinetic exercise increase, oxygen consumption increases. During the isokinetic exercise, one muscle group contracted and as the contraction was maximum, the opposite or antagonist group of muscles relaxed maximally. This cyclic action could decrease the back

pressure in the arterial vessels of the relaxing muscles and in the circulatory system as a whole. The cyclic action could cause a turbulence within the vessels which could prolong the pulsations within the vessel. The pulsations could cause the sound which was heard indicating a drop in diastolic pressure. It is conceivable that these sounds may be heard even if there was no constriction on the artery (16).

Statistically significant differences during isokinetic exercise bouts were found in the mean blood pressure, modified tension time index and pulse pressure.

The mean blood pressure is an indication of the driving force required to push the blood through the circulatory system. The data indicated that the only statistically significant difference occurred between trial seven and trial nine. Although this was statistically significant, it was not clinically important as the value in trial seven occurred at ninety degrees per second while the value in trial nine was the pre-test rest value prior to exercise at 150 degrees per second (Figure 20).

Trials ten to twelve indicate isokinetic exercise at 150 degrees per second. The significant differences at this speed occurred between trial ten and trials eleven and twelve. This difference indicates that

oxygen consumption increases with each interval of isokinetic exercise. The statistically significant differences between trial two and trials eleven and twelve, between trial three and trials eleven and twelve, and between trial six and trials eleven and twelve indicate that as the speed of isokinetic exercise increases, the oxygen consumption increases.

The pulse pressure is the difference between the systolic and diastolic blood pressure (15). As the data indicated (Figure 22 and Table 21), the pulse pressure increased during isokinetic exercise. The largest statistical difference occurred between the pre-test rest levels and the exercise levels. Trials two to four indicate isokinetic exercise at thirty degrees per second. Although the values between the first and third exercise bout were not statistically significant, Figure 22 does indicate that pulse pressure does increase with each exercise bout.

The data for ninety degrees per second (trial five to trial eight) and 150 degrees per second (trial nine to trial twelve) indicate similar results to isokinetic exercise at thirty degrees per second (trial one to trial four). Unlike oxygen consumption as indicated by the modified tension time index, the pulse pressure appears to level off for each bout of exercise as the

speed of isokinetic exercise increases.

Comparison of Effect of Isometric and Isokinetic Exercise on Heart Rate and Blood Pressure

Statistically significant differences in heart rate were found between isokinetic exercise and maximum isometric exercise. The data indicates that as the speed of isokinetic exercise slows, the heart rate approaches the heart rate of isometric exercise although the differences are statistically significant (Figure 23). As the speed of isokinetic exercise increases, it appears that the heart rate is levelling off and is reaching a maximum level.

When viewing systolic blood pressure, there is a statistically significant difference between isokinetic exercise and isometric exercise. This difference may be due to the contract-relax cyclical sequence of isometric exercise. There is no statistical significance between the different speeds of isokinetic exercise or between the two isometric (quadriceps/hamstrings) contractions (Figure 24). The data indicates that systolic blood pressure increases to a greater extent with isokinetic exercise than it does with isometric exercise.

There is a statistically significant difference in diastolic blood pressure between isokinetic exercise and isometric exercise. This difference, again, may be due to the contract-relax cyclical sequence of isokinetic exercise. Also, the "noise" set up within the vascular walls due to the strenuous movement during the exercise may have led to an erroneous reading which physiologically couldn't be prevented (16). This reading could lead to erroneous readings of mean blood pressure, and pulse pressure as well. There was also a statistically significant difference between the slowest isokinetic speed (thirty degrees per second) and the two faster speeds (ninety and 150 degrees per second). This difference again may have been due to the "noise" within the vascular walls.

There is a statistically significant difference in mean blood pressure, modified tension time index, and pulse pressure between isokinetic exercise and isometric exercise. The data indicates that mean blood pressure is less during isokinetic exercise indicating that the force necessary to drive the blood through the circulatory system is less with isokinetic exercise. This decrease may be due to the pumping action of the muscles as they contract and relax during isokinetic exercise.

Modified tension time index is greater during isokinetic exercise than during isometric exercise. This

higher value indicates that myocardial work and hence oxygen consumption increased more during isokinetic exercise than during isometric exercise.

Pulse pressure is greater during isokinetic exercise than during isometric exercise. This higher value is due to the increase in systolic blood pressure while the diastolic blood pressure drops during isokinetic exercise. During isometric exercise, both systolic and diastolic blood pressure rise.

The data and its statistical analysis indicates that isokinetic exercise places a greater stress on the cardiovascular system than does isometric exercise. For this reason, when one uses an isokinetic device to test or exercise a person or patient, one must be sure the subject has no known cardiovascular problems. It would appear that both isometric and isokinetic exercise place a relatively high stress on the cardiovascular system and therefore should be used with care both for exercising and testing. Further research must be carried out to determine the effects of isokinetic exercise on different age groups, different sexes, and on subjects with known cardiovascular problems.

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CHAPTER VI

SUMMARY AND CONCLUSIONS

The purpose of this study was to determine the effect of isokinetic exercise on heart rate and blood pressure at three different speeds of movement and to determine if an isokinetic interval program had a cumulative effect on heart rate and blood pressure. In addition, the quadriceps and hamstring muscle groups were tested isometrically on the Cybex II isokinetic apparatus. The effects of isometric exercise on heart rate and blood pressure were observed and compared with the results found in previous studies. A sample of twenty-four subjects was studied.

The testing procedure involved testing four increments of isometric strength on one day (maximum voluntary contraction (MVC), seventy percent MVC, thirty percent MVC, and ten percent MVC), and testing three different speeds (thirty degrees per second, ninety degrees per second, and 150 degrees per second) on the isokinetic apparatus (Cybex II isokinetic apparatus) on three consecutive days. The order of exercise was determined by a Latin Square Design.

The data was analyzed by means of one-way, two-way, and three-way analysis of variance. Significant

measurements at the .001 level of confidence were subjected to a Tukey or Scheffe Test.

Within the restrictions of the study, the null hypothesis was rejected at the .001 level of confidence for isokinetic exercise at all three speeds used - thirty degrees per second, ninety degrees per second, and 150 degrees per second. The data from the study allowed the following conclusions:

1. Heart rate increased with both isometric and isokinetic exercise. This increase in heart rate was greater for isokinetic exercise than isometric exercise.
2. Systolic blood pressure increased with both isometric and isokinetic exercise. This increase in systolic blood pressure was greater for isokinetic exercise than isometric exercise.
3. Diastolic blood pressure increased with isometric exercise and fell with isokinetic exercise.
4. Mean blood pressure was higher during isometric exercise than during isokinetic exercise.
5. Modified tension time index was higher during isokinetic exercise than during isometric exercise indicating more myocardial work and hence more oxygen consumption during isokinetic exercise.

6. Modified tension time index increased with each bout of isokinetic exercise at a specific speed indicating a cumulative effect of isokinetic exercise on oxygen consumption of the heart.
7. Modified tension time index increased with each increase in speed of isokinetic exercise indicating more myocardial work and hence an increase in oxygen consumption as the speed of isokinetic exercise increases.
8. Pulse pressure was greater during isokinetic exercise than during isometric exercise.
9. Pulse pressure increased with isokinetic exercise.

The results of this study compare the effect of two exercise modes on heart rate and blood pressure. Isometric exercise has, for some time, been known to increase the stress on the cardiovascular system which may be detrimental to people with cardiovascular problems. The data from this study concerning the second mode of exercise (isokinetic exercise) implies that this form of exercise may place an even greater stress on the cardiovascular system.

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APPENDIX A
INFORMATION TO POTENTIAL SUBJECTS FORM

Information to Potential Subjects

The testing sessions for each subject will take approximately three hours spread over four attendances. The first session will take one hour to one and a half hours and the other sessions will be of equal duration. The sessions will be on four consecutive days at the same time each day. No pre-training is required for participation in this study which is concerned with the effect of isokinetic exercise on human heart rate and blood pressure.

If you agree to participate in this study you will be asked not to eat, smoke, or drink for a period of four hours prior to your arrival in the testing laboratory. You will also be asked to perform no exercise other than walking for at least thirty minutes prior to the test.

When you arrive in the laboratory, you will be asked to sit in a special isokinetic chair and you will have straps placed around your right ankle to connect you to the isokinetic dynamometer, and straps around your right thigh and waist to stabilize you for the test. Two electrocardiogram leads will be attached to your chest by means of adhesive tape and a blood pressure cuff will be placed around your left upper arm.

During the first test session, you will be asked to perform eight isometric contractions - maximum voluntary contraction (MVC), 70% MVC, 30% MVC and 10% MVC - four for the quadriceps and four for the hamstrings - with the last three contractions being in random order. You will be asked to try and hold each contraction for up to 3 minutes.

During the subsequent three visits, you will be asked to perform an isokinetic interval training program at three randomly assigned speeds ($30^{\circ}/\text{sec}$, $90^{\circ}/\text{sec}$ & $150^{\circ}/\text{sec}$). You will be positioned in the Cybex apparatus as before and the electrocardiogram leads and blood pressure cuff will be attached as before. You will then be asked to flex and extend your knee as fast and as hard as you can for one minute, rest for three minutes, and repeat the one minute exercise, and three minutes rest cycle two more times. On each of the three visits, you will be asked to do one of the three speeds.

While doing the exercises and on completion of each exercise session, you may find that the leg feels very tired or weak. This sensation is only temporary and will disappear within two hours.

The purpose of this information is to assure that

potential subjects are informed of, and fully understand the procedures and possible after-effects to which they will be exposed if they agree to participate in the study. If you have any questions, please discuss these with the investigator before you sign the Informed Consent Form.

Should you so choose, you may end your participation in this study at any time without being required to explain your reasons for withdrawal.

All personal information given to the investigator during this study will be regarded as confidential.

APPENDIX B

CONSENT FORM FOR RESEARCH STUDY

Informed Consent Form for Research Study

I, _____, hereby give my consent to participate in a research study on the effect of isokinetic exercise on heart rate and blood pressure, the general plan of which has been explained to me.

I fully understand as it has been explained to me that by notice given to the undersigned investigator that I may withdraw from this research project any time that I may elect to do so.

Date

Participant's Signature

I hereby certify that I have given to the above individual an explanation of the contemplated study and any possible side effects.

Investigator's Signature

APPENDIX C
PERSONAL DATA FORM

TO: Each person who has agreed to participate in the study to examine the effects of isokinetic exercise on heart rate and blood pressure.

FROM: David Magee

Thank you for being willing to participate in this study.

In order that the results of the study shall be as valid as possible, I would be grateful if you would complete the details below. I assure you that these personal details will not be disclosed at any time to any third person in such a way that you could be identified from them.

PERSONAL DATA FORM

Name:

Age:

Address:

Phone Number:

Please indicate by answering YES or NO in the appropriate column whether you or any member of your immediate family (parents, brothers, sisters) have, to the best of your knowledge, ever suffered from any of the following medical problems:

	SELF	FAMILY
Heart Disease		
Thrombosis		
Varicose Veins		
Swollen Ankles		
Hypertension		
Hypotension		
Respiratory Conditions		

Do you smoke? _____. If so, approximately how many
per day? _____.

Are you presently taking medication for any reason?

_____.

If so, what medication and for what condition?

Date: _____ Signed: _____

APPENDIX D
APPOINTMENT SHEET

TIME	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
11:00						
12:30						
2:00						
3:30						
5:00						
6:30						
8:00						
9:30						

APPENDIX E
CONFIRMATION LETTER

TO: Volunteers who have agreed to participate in the study to examine the effects of isokinetic exercise on heart rate and blood pressure.

Dear :

Thank you for being willing to act as a subject in this study. It has been possible to arrange your test appointments at the times suggested by you.

Your appointments will be on:

_____	at	_____
_____	at	_____
_____	at	_____
_____	at	_____

I would be grateful if you would let me know in advance if, for any reason you are unable to attend for this appointment. You may get in touch with me by leaving a message in my mail box at Corbett Hall or by telephoning 434-6547 or 439-4181 and leaving a message.

You should feel free to invite one colleague to accompany you to the test sessions if you so choose. One of your friends who is not a subject may be glad of the opportunity to see what is being done.

You are reminded that you should not eat, drink, or smoke for a period of four hours prior to the start of your test session.

Please wear a P.E. kit for the test sessions.

I look forward to seeing you.

Yours sincerely,

David J. Magee

APPENDIX F
APPOINTMENT REMINDER FORM

TO: Volunteers who have agreed to participate in the study to examine the effects of isokinetic exercise on heart rate and blood pressure.

Dear :

This notice is just a reminder that you are scheduled for testing next week.

Your appointments as arranged were:

_____ at _____
_____ at _____
_____ at _____
_____ at _____

You are reminded that you should not eat, drink, or smoke for a period of four hours prior to the start of your test session.

Please wear a P.E. kit for the test sessions.

I look forward to seeing you.

Yours sincerely,

David J. Magee

APPENDIX G
CONVERSION CHART

Maximum Voluntary Contraction (MVC) to Percentage Maximum

Voluntary Contraction

MVC(ft.lb)	70% MVC(ft.lb)	30% MVC(ft.lb)	10% MVC(ft.lb)
11	8	3	1
12	8	4	1
13	9	4	1
14	10	4	1
15	11	5	2
16	11	5	2
17	12	5	2
18	13	5	2
19	13	6	2
20	14	6	2
21	15	6	2
22	15	7	2
23	16	7	2
24	17	7	2
25	18	8	3
26	18	8	3
27	19	8	3
28	20	8	3
29	20	9	3
30	21	9	3
31	22	9	3
32	22	10	3
33	23	10	3
34	24	10	3
35	25	11	4
36	25	11	4

MVC(ft.lb)	70% MVC(ft.lb)	30% MVC(ft.lb)	10% MVC(ft.lb)
------------	----------------	----------------	----------------

37	26	11	4
38	27	11	4
39	27	12	4
40	28	12	4
41	29	12	4
42	29	13	4
43	30	13	4
44	31	13	4
45	32	14	5
46	32	14	5
47	33	14	5
48	34	14	5
49	34	15	5
50	35	15	5
51	36	15	5
52	36	16	5
53	37	16	5
54	38	16	5
55	39	17	6
56	39	17	6
57	40	17	6
58	41	17	6
59	41	18	6
60	42	18	6
61	43	18	6
62	43	19	6
63	44	19	6

MVC (ft.lb)	70% MVC (ft.lb)	30% MVC (ft.lb)	10% MVC (ft.lb)
64	45	19	6
65	46	20	7
66	46	20	7
67	47	20	7
68	48	20	7
69	48	21	7
70	49	21	7
71	50	21	7
72	50	22	7
73	51	22	7
74	52	22	7
75	53	23	8
76	53	23	8
77	54	23	8
78	55	23	8
79	55	24	8
80	56	24	8
81	57	24	8
82	57	25	8
83	58	25	8
84	59	25	8
85	60	26	9
86	60	26	9
87	61	26	9
88	62	26	9
89	62	27	9
90	63	27	9

MVC(ft.lb)	70% MVC(ft.lb)	30% MVC(ft.lb)	10% MVC(ft.lb)
91	64	27	9
92	64	28	9
93	65	28	9
94	66	28	9
95	67	29	10
96	67	29	10
97	68	29	10
98	69	29	10
99	69	30	10
100	70	30	10
101	71	30	10
102	71	31	10
103	72	31	10
104	73	31	11
105	74	32	11
106	74	32	11
107	75	32	11
108	76	32	11
109	76	33	11
110	77	33	11
111	78	33	11
112	78	34	11
113	79	34	11
114	80	34	11
115	81	35	12
116	81	35	12

MVC(ft.lb)	70% MVC(ft.lb)	30% MVC(ft.lb)	10% MVC(ft.lb)
------------	----------------	----------------	----------------

117	82	35	12
118	83	35	12
119	83	36	12
120	84	36	12
121	85	36	12
122	85	37	12
123	86	37	12
124	87	37	12
125	88	38	13
126	88	38	13
127	89	38	13
128	90	38	13
129	90	39	13
130	91	39	13
131	92	39	13
132	92	40	13
133	93	40	13
134	94	40	13
135	95	41	14
136	95	41	14
137	96	41	14
138	97	41	14
139	97	42	14
140	98	42	14

MVC(ft.lb)	70% MVC(ft.lb)	30% MVC(ft.lb)	10% MVC(ft.lb)
141	99	42	14
142	99	43	14
143	100	43	14
144	101	43	14
145	102	44	15
146	102	44	15
147	103	44	15
148	104	44	15
149	104	45	15
150	105	45	15
151	106	45	15
152	106	46	15
153	107	46	15
154	108	45	15
155	109	47	16
156	109	47	16
157	110	47	16
158	111	47	16
159	111	48	16
160	112	48	16
161	113	48	16
162	113	49	16
163	114	49	16
164	115	49	16
165	116	50	17
166	116	50	17
167	117	50	17

MVC(ft.lb)	70% MVC(ft.lb)	30% MVC(ft.lb)	10% MVC(ft.lb)
168	118	50	17
169	118	51	17
170	119	51	17
171	120	51	17
172	120	52	17
173	121	52	17
174	122	52	17
175	123	53	18
176	123	53	18
177	124	53	18
178	125	53	18
179	125	54	18
180	126	54	18
181	127	54	18
182	127	55	18
183	128	55	18
184	129	55	18
195	130	56	19
186	130	56	19
187	131	56	19
188	132	56	19
189	132	57	19
190	133	57	19
101	134	57	19
192	134	58	19
193	135	58	19

MVC(ft.lb)	70% MVC(ft.lb)	30% MVC(ft.lb)	10% MVC(ft.lb)
------------	----------------	----------------	----------------

194	136	58	19
195	137	59	20
196	137	59	20
197	138	59	20
198	139	59	20
199	139	60	20
200	140	60	20
201	141	60	20
202	141	61	20
203	142	61	20
204	143	61	20
205	144	62	21
206	144	62	21
207	145	62	21
208	146	62	21
209	146	63	21
210	147	63	21
211	148	63	21
212	148	64	21
213	149	64	21
214	150	64	21
215	151	65	22
216	151	65	22
217	152	65	22
218	153	65	22
219	153	66	22
220	154	66	22

MVC(ft.lb)	70% MVC(ft.lb)	30% MVC(ft.lb)	10% MVC(ft.lb)
221	155	66	22
222	155	67	22
223	156	67	22
224	157	67	22
225	158	68	23
226	158	68	23
227	159	68	23
228	160	68	23
229	160	69	23
230	161	69	23
231	162	69	23
232	162	70	23
233	163	70	23
234	164	70	23
235	165	71	24
236	165	71	24
237	166	71	24
238	167	71	24
239	167	72	24
240	168	72	24
241	169	72	24
242	169	73	24
243	170	73	24
244	171	73	24
245	172	74	25
246	172	74	25
247	173	74	25

MVC(ft.lb)	70% MVC(ft.lb)	30% MVC(ft.lb)	10% MVC(ft.lb)
248	174	74	25
249	174	75	25
250	175	75	25
251	176	75	25
252	176	76	25
253	177	76	25
254	178	76	25
255	179	77	26
256	179	77	26
257	180	77	26
258	181	77	26
259	181	78	26
260	172	78	26
261	173	78	26
262	173	79	26
263	174	79	26
264	185	79	26
265	186	80	27
266	186	80	27
267	187	80	27
268	188	80	27
269	188	81	27
270	189	81	27
271	190	81	27
272	190	82	27
273	191	82	27

MVC(ft.lb)	70% MVC(ft.lb)	30% MVC(ft.lb)	10% MVC(ft.lb)
274	192	82	27
275	193	83	28
276	193	83	28
277	194	83	28
278	195	83	28
279	195	84	28
280	196	84	28
281	197	84	28
282	197	85	28
283	198	85	28
284	199	85	28
285	200	86	29
286	200	86	29
287	201	86	29
288	202	86	29
289	202	87	29
290	203	87	29
291	204	87	29
292	204	88	29
293	205	88	29
294	206	88	29
295	207	89	30
296	207	89	30
297	209	89	30
298	209	89	30
299	209	90	30
300	210	90	30

APPENDIX H
CALIBRATION CHART - ISOKINETIC APPARATUS

CYBEX CALIBRATION

RECORDER SCALE SELECTOR	LEVER ARM Inches*	WEIGHT Pounds	CALIB. TORQUE INPUT Foot Pounds	GRAPH RECORDING PEAK
360	30	70	180	5 Major Divisions
180	31	32.5	90	5 Major Divisions
30	33	5	20	20 Major Divisions

CALIBRATION POINTS (mid-scale)

360 Scale *30"	70 lbs on arm yields 180 ft lbs (5 Major Divisions)
180 Scale *31"	32.5 lbs on arm yields 90 ft lbs (5 Major Divisions)
30 Scale *33"	5 lbs on arm yields 20 ft lbs (20 Major Divisions)

*Distance from center of CYBEX input shaft to center of T tube (lever arm length).

Procedure:

1. Select Recorder Range scale (0-30, 0-180 or 0-360).
2. With Speed Selector ON at 5 RPM and Recorder ON but no torque applied to input shaft:
 - a) Select #4 position on Damping control.
 - b) Select slow chart speed (2mm/sec).
 - c) Align stylus with baseline of chart paper grid using Zero Adjust control.
 - d) Check to see baseline does not shift when range scale is changed. Plus or minus small division of change on the 30 scale is acceptable. Baseline shift can be corrected by adjusting with a small screwdriver the potentiometer behind the cap marked ZERO on the front vertical panel of the recorder case.
3. Attach proper amount of disc weights to T bar as per above calibration. Check accuracy of weights first as a 25 lb. weight may be off as much as 1/2 lb. from its indicated value. A 2 1/2 lb. weight may be off 1/4 lb. Use correct weight value.

4. Dynamic calibration is done by manually lifting weighted T bar to vertical position above dynamometer, then allowing it to swing down until weights contact the floor. As weighted arm passes the horizontal, it is applying the specified torque. The graph recording will show this value as the maximum point on the curve. If this point is above or below the correct torque value, adjust the recorder and make it read the correct value by turning the appropriate (30, 180, 360) potentiometer behind the plug on the front case of the recorder using a small screwdriver. Turning the pot clockwise will decrease the reading and counterclockwise will increase it.

APPENDIX I
ISOMETRIC LABORATORY WORK SHEET

ISOMETRIC LABORATORY WORKSHEET

SUBJECT NUMBER: _____

HEART RATE (bpm)	5 Minute Rest Period	MVC 1 Minute	5 Minute Rest Period	% age MVC 1 Minute	5 Minute Rest Period	% age MVC 1 Minute	5 Minute Rest Period	% age MVC 1 Minute	5 Minute Rest Period
	1	1	1	1	1	1	1	1	1
	2		2				2		2
	3		3				3		3
	4		4				4		4
	5		5				5		5
QUADRICEPS									
	1	1	1	1	1	1	1	1	1
	2		2				2		2
	3		3				3		3
	4		4				4		4
	5		5				5		5
HAMSTRINGS									
	1	1	1	1	1	1	1	1	1
	2		2				2		2
	3		3				3		3
	4		4				4		4
	5		5				5		5
Blood Pressure (mmHg)									
QUADRICEPS									
	1	1	1	1	1	1	1	1	1
	2		2				2		2
	3		3				3		3
	4		4				4		4
	5		5				5		5
HAMSTRINGS									
	1	1	1	1	1	1	1	1	1
	2		2				2		2
	3		3				3		3
	4		4				4		4
	5		5				5		5

APPENDIX J
ISOKINETIC LABORATORY WORK SHEET

ISOKINETIC LABORATORY WORKSHEET

Subject Number: _____

	5 Minute Rest Period	1 Minute Exercise	3 Minute Rest Period	1 Minute Exercise	3 Minute Rest Period	1 Minute Exercise	Rest Period (Return to Resting Value)
<u>SESSION ONE</u> SPEED:	Heart Rate (bpm)	1	1	1	1	1	1 6
		2	2		2		2 7
		3	3		3		3 8
		4					4 9
		5					5 10
	Blood Pressure (mmHg)	1	1	1	1	1	1 6
		2	2		2		2 7
		3	3		3		3 8
		4					4 9
		5					5 10
<u>SESSION TWO</u> SPEED:	Heart Rate (bpm)	1	1	1	1	1	1 6
		2	2		2		2 7
		3	3		3		3 8
		4					4 9
		5					5 10
	Blood Pressure (mmHg)	1	1	1	1	1	1 6
		2	2		2		2 7
		3	3		3		3 8
		4					4 9
		5					5 10
<u>SESSION THREE</u> SPEED:	Heart Rate (bpm)	1	1	1	1	1	1 6
		2	2		2		2 7
		3	3		3		3 8
		4					4 9
		5					5 10
	Blood Pressure (mmHg)	1	1	1	1	1	1 6
		2	2		2		2 7
		3	3		3		3 8
		4					4 9
		5					5 10

APPENDIX K
LATIN SQUARE DESIGN
FOR
PERCENTAGE MAXIMUM VOLUNTARY CONTRACTIONS
AND
SPEEDS OF ISOKINETIC EXERCISE

70% MVC	30% MVC	10% MVC
A	B	C
B	C	A
C	A	B
A	B	C
B	C	A
C	A	B
etc		
150 degrees/second	90 degrees/second	30 degrees/second
A	B	C
B	C	A
C	A	B
A	B	C
B	C	A
C	A	B
etc		

(from B.J. Winer, Statistical Principles in
Experimental Design, 2nd edition, 1971, pg. 685)

APPENDIX L

Raw Data

INDEX

1. Raw data for isokinetic rest-heart rate
Read 062; 058; 060; 075; etc.
2. Raw data for isokinetic rest-blood pressure
Read 130/088 (systolic/diastolic); 130/086;
130/090; etc.
3. Raw data for isokinetic exercise-heart rate
Read 060; 104; 102; 100; 065; etc.
4. Raw data for isokinetic exercise-blood pressure
Read 130/88 (systolic/diastolic); 210/66;
200/72; etc.
5. Raw data for Isometric rest-quadriceps-heart rate
Read 070; 087; 078; 080
6. Raw data for isometric rest-quadriceps-blood pressure
Read 122/082 (systolic/diastolic); 122/084;
120/084; etc.
7. Raw data for isometric rest-hamstrongs-heart rate
Read 077; 080; 070; 082; 077
8. Raw data for isometric rest-hamstrings-blood pressure
Read 120/084 (systolic/diastolic); 116/084;
118/084; etc.
9. Raw data for isometric exercise-quadriceps-heart
rate
Read 110; 087; 078; 090
10. Raw data for isometric exercise-quadriceps-blood
pressure
Read 140/110 (systolic/diastolic); 130/100;
120/88; etc.
11. Raw data for isometric exercise-hamstrings-heart rate
Read 100; 096; 085; 085.
12. Raw data for isometric exercise-hamstrings-blood
pressure
Read 140/110 (systolic/diastolic); 142/110;
etc.
13. Raw data for isokinetic rest
 - (a) mean blood pressure (V28-V36)
 - (b) modified tension time index (V37-V45)
 - (c) pulse pressure (V46-V54)

14. Raw data for isokinetic exercise
 - (a) mean blood pressure (V37-V48)
 - (b) modified tension time index (V49-V60)
 - (c) pulse pressure (V61-V72)
15. Raw data for isometric rest-quadriiceps
 - (a) mean blood pressure (V16-V20)
 - (b) modified t-nsion time index (V21-V25)
 - (c) pulse pressure (V26-V30)
16. Raw data for isometric rest-hamstrings
 - (a) mean blood pressure (V16-V20)
 - (b) modified tension time index (V21-V25)
 - (c) pulse pressure (V26-V30)
17. Raw data for isometric exercise-quadriiceps
 - (a) mean blood pressure (V13-V16)
 - (b) modified tension time index (V17-V20)
 - (c) pulse pressure (V21-V24)
18. Raw data for isometric exercise-hamstrings
 - (a) mean blood pressure (V13-V16)
 - (b) modified tension time index (V17-V20)
 - (c) pulse pressure (V21-V24)
19. Raw data for comparison of isokinetic and isometric exercise-heart rate
20. Raw data for comparison of isokinetic and isometric exercise- systolic blood pressure
21. Raw data for comparison of isokinetic and isometric exercise- diastolic blood pressure
22. Raw data for comparison of isokinetic and isometric exercise- mean blood pressure
23. Raw data for comparison of isokinetic and isometric exercise- modified tension time index
24. Raw data for comparison of isokinetic and isometric exercise - pulse pressure

1. Raw data for isokinetic rest-heart rate
Read 062; 058; 060; 075; etc.

```

1 062058060075063065073065070070060067065068061059062062
2 062065067085075075083068075083075070070078073065060072
3 060063065075065070078073072080074068074072074070070076
4 065073067075062110102093100096075090080090085080090090
5 058060060060060095060063095090083068085070080080073080
6 064060060083075095115087115095097092090085090076087095
7 057055055070065080074065073070060065057062061070058060
8 054048058070065063075072072072070073060062065060059062
9 052055052075062070070070085097068062070070068060065062
10 050055055070058083065067082073056060065054053061062058
11 044035055080080095105090110100087078076075075074076073
12 057043044062061054073068078087073070072065062063070068
13 054058058073070060098060075076072073063068065065063066
14 053057053083072087078069078086075097075078068070065075
15 055062050083068075085075088092094090083075065072063070
16 056055055065055065070063065072065070070070067072073065
17 063058070075075075095077090093080080083080080078080078
18 055060050082072080090095100103093085084085083085085082
19 085090073088070070075075110077090080077075078080073074
20 055055080080065107070087112075068070075078082068085085
21 083070074060085085095098118090090084085086087086084085
22 047065063068070075077060057075070064065063065075068058
23 075073075090093102112095110108100092087087090083085085
24 055063063085072090092087100100080085080078070073075080
25 070070070080070087087076088090078070080075075085085085
26 067080070090075075075075085083075090075075085085078086
27 070073070080075078088080085078080085085095085090080081
28 071057062075060065093064090100075075080075070070065065
29 062057060085083088101095095096094086077074073078075077
30 066066053087078080093087090096085078076080075080076073
31 058066056067065090072080075090085075078080080082083084
32 04504706007806509007507509508508508308708307808308080
33 042044045068082090089080088100090090080078083080080080
34 086082086098098090095090090103090095095088100100101085
35 065070075097085090100080097100085087087092085085095090
36 090085078100095095112108106116100105100103095095095087
37 063065060058060065063065070067062068065070065066070065
38 082080080090080080070085090090095080090080087085077070
39 062066066078058070077070085084083072087067070070072080
40 045048047053047070063071070065055050060055055060055055
41 047045055048060055060068073082070060070067075062060062
42 050055047082050065080065083070078060065070070075085055
43 065055060086070070080070085075078070060065070070057065
44 060065060080060075078074093080080062070055055053057055
45 065052050075065072065056065070057058055055065060060056
46 052050055060060060052061084065060078070078090078065065
47 053052055082058085085072087078075072072075068075068075
48 050049053080080090085093096095095093085083080085075080
49 080070085090085085087085083083080080080080083080080085
50 070065060073070080080073086082085080080076083080080080
51 070070068070068083085083093087086080082085087085087087
52 050063048058057098087088102103087095084080083077090084
53 080055060110100115115115125125123107107104100100097097
54 072064056115090117122112123125113111115106105110120105
55 043037048055042062045055060075055057056055055055045047
56 053055050055058060074065055080063057073055044062065060
57 045047037063052067070055054078048058060060060060057055
58 062060065070065070067069063070060060065065066063068070
59 065065060090070078081075080093080080070070070065065070
60 060062059078078073083080090085085077073078072070067075

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61 045042044050075080080049085096080065067070062070075075
62 057047040090080095095090095107090080078075076077072075
63 053047060090053080105090100093095074083075077073070076
64 092085077102077105100090105112094100095095095095097095
65 087090085107104143127113126130117115110107105100110105
66 080077077103083097115105120127110105102108100108103103
67 047052050052045060063060065080070073070073065063073057
68 045045047087060073105085087112090097085065085085085090
69 050052055090070092105100103123107096093093095095090105
70 106095115120112125135125136145125118117115110110108107
71 085070075112087112120110113124107093100090095090100090
72 076053060120108110125120123140112108107105095100095100
END OF FILE
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2. Raw data for isokinetic rest-blood pressure
 Read 130/088 (systolic/diastolic); 130/086;
 130/090; etc.

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1 130088130086130090140078132084130088138078134080126086
2 140070142082130086136084128088128086126086130086130086
3 115078112080114080130074130078128070140070124076122076
4 136076130074122076120078122076122076120080120080118080
5 110078112076112078132068118076115076132076128076138076
6 144068136078128074128076124080124076124076120076118070
7 120078118080118080152068140070132074158070140076138078
8 164070142076132076132080132078128078122076118074122070
9 120086120086120086164076150078136080172074150080148078
10 180068168072140080136078130076132076128072120080122080
11 126088126088120088152080142086140080178076164086150088
12 184072156086152088140088130084130080130082128080120080
13 130082128084130080160090140088142088178092158088158088
14 190076160082148084142088142084132082138088130088130088
15 120088118088120090172080160080142082182084166088154088
16 182088160086148088146088138088138090136088134088130090
17 124090126092128090170080156090150090190088170092170090
18 190092170090152090142088142084142088138086132088132082
19 125068124068124068168040146060148068162040158060150060
20 160052148060140060136060136062128062128068128062128066
21 130076132082132080170020170020170025178010178015174015
22 178010166015160030156050152056150056142058140064140066
23 128080130080130078156050144054120066160042158040148042
24 170010152044148050144050138060140066136070132070130072
25 112080116078114076120076120072124080136064120070120070
26 158072130072122076120076120078118078112078114076112078
27 128082126084126084138078140084136086146080138084138080
28 148072150072132082132084134080130082130084130084128082
29 114076116078112078148068128070132078148068140072126084
30 148076140070140070140072138070130070128070120070120072
31 124100126096128100164090158084136084170084150090140092
32 170088150094150094146100138096140100142098142102138100
33 122080124088122080166076150092140080160092150090152090
34 180090160080158084152086150086148084148084138084140088
35 130084130086130086162082160080160080177086170080162084
36 184080170084152088150082150086150080146086144086144084
37 116084112088112084140072138080142080142088132080132084
38 146082142086138090130088132088128090128090124088124088
39 122080122080120080144064140068140080158060148080144080
40 168060140070136070136080136078132080128080126080124080
41 118090120088118090155076136078132082152080132082132088
42 148074138088130076124080122082118084118080116084112086
43 118088118084118078120068116072118072142078126078122080
44 130080136080124082124080124080126080124080122082122084
45 116084118084120088154976150078136080166076150076130080
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47 118084118078118082144080138080140082150072132086138080
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54 150080130082130080130082128080126084122084120084120086
55 110064112066112064120068116068120070128072122078118080
56 138064126070118072118072116072110070116070120070122074
57 110076110076110076140064128068126072156076140078138078
58 162-72140078136076128074126070118070118070112072112072
59 106074106076104076140070128072128070150068138064130066
60 144070138070130072120072118068110066106070106070106068

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61 130084130086132086160074152076156078178078158076154072
 62 178076162080144082142080142074140074138068134070134070
 63 116074116074118076150062150070138066174060160064154070
 64 182070160072150072146070134066132068134074132074130070
 65 130084128086128086166072152076150086180052166080156080
 66 174072150080146076142076134072130070124070122070124070
 67 118082122084120080156080132088130088144080134082134080
 68 158084142088140088140088136088132086130086130084126084
 69 120088120088122088138084136086132086154084140082140084
 70 156088140088140086138082130084130082126084120084124086
 71 115086112082114082150070138070130074162078140084138084
 72 158086144084138082132088132084132080128080126078122080
 73 120084118084118084146070140076138074140064132070120070
 74 142064125073122078118076118076124080120080118080118080
 75 116074116076116070132040126058126060160040134050130056
 76 150048142056136060130060122062120060120070118068110072
 77 120084120084120084138062136070130078138046124066124076
 78 138050136060136068130070120070120074116078112080110080
 79 110078108078104078124080118080114080138078126080120082
 80 136070132080132078128078122072122078122080120080116080
 81 106074104076106078138060130072126070152068130070134070
 82 154060140068130074124074120072118078114076114074114072
 83 108080108080110082146070157068126068152076144078140080
 84 152068140076132074124076118076112072114070112072112074
 85 120070110070110064148058142060130064148060134066134072
 86 150052136068130066132066130068128068124070120072120068
 87 120076118074112074156040150042148040168040152042148052
 88 152056144064140064136066130068120068120068120070122072
 89 124072122072122074160040155056154060170048160050150060
 90 168048150052158058146060140064140064138064134064128064
 91 116078116076116076144074130080130078152072140080136080
 92 154068132070132074126070120080120082120084120078120080
 93 118078118078114078146070136072134072148068144072138072
 94 152060140074138086132080130080124078128078124078122078
 95 118084118084116080158064146074140078160078150086150082
 96 164068160080148082140084136080130080130072126076124076
 97 130084130086130086148070140088136088148074140080140084
 98 152068140078132080140080130084130086130084128086126086
 99 116090116090116088144070138076138078142070138072130072
 100 150072138078132076128076122080120078116078116080116078
 101 122088122088124090170068164072155076170078154080148080
 102 170068158084138086134080134082130084128084128084126084
 103 114080112078112080130066126068128070150060138064126068
 104 158060134064132070130072128072124076126078124076120076
 105 112080114076112076146068140074128072160068158080140076
 106 160064140080138080138078128076122078122076130072126074
 107 100078110078110080138064136070130074140050138076140076
 108 160058158076154076148076144076140076132078138078138080
 109 114084112086112086134080130084124078148076142080136080
 110 144076143080132084130082130082124080122080120082118080
 111 128088126088124088144076130084132082148072138072138076
 112 152068138084128082128084126084124084124084124086124086
 113 122090116090118086140068124070122070160062132070134070
 114 158056140068136070132074130076128072126080126084124082
 115 116070112076110074138058118068110070128058120068112070
 116 138060120068112070110068108078108072104074102074102076
 117 104070104076102078126064114060112064132060126068120064
 118 142068122070122064118068116072110072106072108070106070
 119 110076112076110078130060118064118064142060120062108068
 120 140064132064118070116070114070114068116070112068110070


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121      110084112088114084152058130060122070164040154056140068
122      174042150060132070122068126070122070118070110070116070
123      128080128080130080176056150060142070182030170058154064
124      188030148050144060140064140064132066130070128070126072
125      110080108080112080168066160072144070184068162076158076
126      210040190060158068152068152068140068142070134070132070
127      106072104072104072135078128074124076132070124070122072
128      160072150078128078118074108074106072104078106078106080
129      110068108068108066138056132050130055142060136062130064
130      150060142062138064120066120068120068120070118072116074
131      112086112084112080162052146074128070164056162050140068
132      164060152068144070136070128070124072120072116074114076
133      124078126078120078150060140072134072150070150072142072
134      164072150076148072144078126080124080124080124082122084
135      132090132090134088180072172060164055208025180054160058
136      194020176060159068150066144076150078148078130080138080
137      130084130086130084170058168070164076190035178058170064
138      196045170058170064132068140068140072140080142080142080
139      112084110084112086132070128076126080144068140076130072
140      142052136070134070132070126070120070118070116068110070
141      110076112070114070150056134062130064160030148058132060
142      160040144056116060112064112070112070114070114070112068
143      116074116070118076168020154050138060174060155062155064
144      178040155045140068140068134068122068120066116064116068
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END OF FILE

3. Raw data for isokinetic exercise-heart rate
 Read 060; 104; 102; 100; 065; etc.

```

1      060104102100065115112118063112112115
2      060145155160068153160165061153160169
3      056132138144053140140150053138147150
4      055130138128046135150149047120131143
5      056137145150055140150143054150155162
6      057110115125064137150148053130139127
7      083115123137066115118130080135140140
8      059113115128074150158150060135142150
9      069135143147073132140148070127140167
10     061118125135060128140145060135145152
11     059120142146052134150153044142153160
12     083135126140070116120125081144148153
13     063090113112080130135142065125133135
14     047108133142049142145157051140150157
15     060136152155061145146148056137143145
16     052140152153053143150152052150160160
17     081135135145064138146159069155160166
18     052162174183070193205207064183190193
19     042125142142053123136138044133143153
20     064100105112064125133138059115132127
21     043143155162049150166172051147163170
22     084165174195085175183187080177187193
23     050130146163049165175175052158175173
24     105163185190077180187193063186190195
END OF FILE

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4. Raw data for isokinetic exercise-blood pressure
 Read 130/88 (systolic/diastolic); 210/66;
 200/72; etc.

```

1      130882106620072189601147918056180501725011177150601506417058
2      119791645419052180501208618058176581725012588170721906418564
3      129822106821070210741208918076210682207212791210552206422068
4      126681981019810190081327919025180101780512880190302051020005
5      113771604816040190401278518062170562006011379170451704516050
6      126991706018058180681228419068190481904513085180601754519250
7      114851906019264189581218017050180402103811990180441824017638
8      118821606416052148601188417068168701706211882180621685517060
9      135931506815576160721279717062180721787012796170761848219078
10     112651985616450166601107615664184561806810675152681706617054
11     131851885819272194681177418045192281942812986168481883219035
12     121831905019045190501238816872192721965811484160381794017240
13     119841685417045168481177215825158101701512087160381682816030
14     108781647017068168641067615048170521584810981168551606016060
15     113691922018910202101157419220194101991012374176202051021505
16     116782057220555210601177817050172641784011783170601804019050
17     129861885418042196381168919955188301764012388192401964619640
18     113811605416438158151137715825150201584010778144401483015225
19     115851484015230158201278914645160301703011788158351602515820
20     114731405214235150401037414250164481605011176146581585215058
21     112841701518205190051308318220186101921011081190241981521015
22     106721624015842158321096814030145301582011384170101781017810
23     125791625516830166201329019605190101900513184192151971619810
24     114841402514810152201137315510168051681011674162101701017410
END OF FILE

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5. Raw data for isometric rest-quadriceps-heart rate
Read 070; 087; 080; 078; 080; etc.

1	070087080078080	61	096060057070074
2	068072075077075	62	077080073072063
3	062063068057075	63	070070056065068
4	058050052052075	64	068053052058072
5	063060067070065	65	066067062065070
6	055055052055060	66	074068080085073
7	080088083065082	67	075060057050056
8	070068070062070	68	060067048060048
9	062063060059080	69	065058053052085
10	060067062062080	70	112092102103098
11	060065063067075	71	067060056057065
12	050050050053070	72	070065070067070
13	060060065080085	73	070080073078084
14	065073073068067	74	090092083087097
15	056063058075085	75	070077052050067
16	058050083054085	76	067062059070055
17	062074057070075	77	080075073074070
18	070055070070064	78	056057059063058
19	065056056062062	79	083095080077090
20	045055045040080	80	080060062065058
21	055062064060050	81	068068065068067
22	087085087087108	82	072082063065067
23	060061072065070	83	064065058063070
24	065058058068074	84	053050045060053
25	080080080075083	85	063063067060065
26	086083086078085	86	082077068073070
27	060065059050070	87	072075072065072
28	065057065060070	88	060050060055070
29	065060078073068	89	074068065068068
30	063060062048061	90	063098087075065
31	084082080073095	91	063055053065063
32	075065068063080	92	070077065055065
33	065067060068065	93	075052067050080
34	070075075065063	94	112110105100103
35	060060070067086	95	070070060060067
36	050053053052055	96	064060053056053
37	063068066066060	97	083082073073072
38	067068072075087	98	090083082085087
39	073074070058088	99	065060055059062
40	070067070058080	100	062053055055052
41	065077066070072	101	077076075074085
42	077060077055078	102	055054057060058
43	043060060055068	103	086079075080078
44	048046055047075	104	072065058075058
45	060050073055067	105	078077065072063
46	106105111100113	106	067061062066060
47	065065060065062	107	085075067070072
48	070062068063073	108	053053043052056
49	087083078074076	109	072072068074062
50	093082090080080	110	075074071073075
51	065062062064072	111	055055058070065
52	075062060050053	112	085055057068050
53	074080083075070	113	077073070068065
54	065055053054057	114	070083060080073
55	085087065090078	115	087083065053055
56	056061071060068	116	062052050057048
57	077065060064070	117	064060050050050
58	070069068058065	118	115120100120100
59	075080070062083	119	065065060072065
60	063055047060047	120	055050055055055

6. Raw data for isometric rest-quadriceps-blood pressure
 Read 122/082 (systolic/diastolic); 122/084;
 120/084; etc.

1	122082122084120084118090120090	61	122078112084114078114078112076
2	120084120082122084122088120090	62	124080120080122084120086122090
3	120088122088118088118090120090	63	140064138070130074130076116072
4	132090132084128080130096130094	64	122086114072112080112082114082
5	130090124090126090126092126100	65	148090148088132094130088130092
6	110080110078118076120084118076	66	130070118072110074114078114078
7	120084120098118086120078122092	67	142080130084128088130088128088
8	140100142100140100142100146100	68	144070130070126076126078130076
9	124092122092124090124092124092	69	120066120064114064110068108064
10	104078106078108074110076104076	70	128086118078118078118080120080
11	128080128084128080128080128086	71	110060104060100064104070104070
12	112078110076110076110078112084	72	136080140086134086138086136086
13	118084118088120086118086122088	73	122088122090122088122084122086
14	112090112090112088112088112088	74	130096128096110090110092110094
15	112078114070116076114080116070	75	132080132080130070128084118084
16	110080106076110080108080114084	76	140090138088140088138088142090
17	120090130094132094134094136098	77	138090128088128090120084122090
18	112076110080118080116078116080	78	150080140084144074130070132068
19	126092128090128090128090128090	79	132082122098124092118080120082
20	110090110088112088112088112088	80	158108142100144098144100144098
21	108070106066108068108070110070	81	140092134092128090128094128088
22	112080110076108080110078110080	82	120072112080112072112072114070
23	106068104068104068104068104070	83	146080146078144078140080136080
24	128082126082126082126080126084	84	120080110076110076108076110076
25	120084120084124084122086122088	85	124084122084116084116082114080
26	130090128088120090122090122088	86	126090128086119086118086118086
27	138084136088128088132092132090	87	136080130076132084134078136076
28	140088128086138090138088140090	88	122082112078110080110082110080
29	120088120090118090122094130100	89	138090136090126090126092124094
30	142082134072132070132068132068	90	128070124072122072118074122076
31	120084120084120090120090120092	91	130088128088126090126090124090
32	155108153100144098142098144098	92	132076120080134090134090140082
33	130096128096132090130098130096	93	122056118060110060110068112070
34	126072110072110080108078108076	94	110090118086130088128086126080
35	138080124086132078132084132086	95	110070108068108070104068104070
36	120080112080112080110080110080	96	138084134080134080136080136080
37	120084118084116084116086116086	97	130090124088124088118080120084
38	120088120086120084120086120086	98	122090122090124090112090118090
39	140078136078124074130076124078	99	132086126080124080120088118090
40	115088112084112086110084110084	100	156098148090138088138088138084
41	144094136098136098140100142100	101	138098130098130090120090120092
42	128076118076118076120076116074	102	130076128074126070127070122072
43	120088120090118090116090124090	103	122084120080124082124080122082
44	128076130078128078128086124080	104	152110154110144096146096140096
45	118070116070110070112070110070	105	132098138100130100130098130094
46	120080122084108080112086110088	106	112080110072104072102076102074
47	106068100070100070100070100068	107	150080142082140086138086130080
48	130084130088138086132084132086	108	124080120082122080120078118084
	130092128086130084128088126080	109	130080128084120080118080118084
	140092130092130112128090130092	110	128088120080120084118084120084
	132080132080130070128084118084	111	130088130080122074120076120076
	150100160110154094140090140096	112	120080120084118084118086118082
3	128096120094124090130088124092	113	126098126090130092130090132092
54	140080130064128064124066130068	114	130080116074116074116076114070
55	120088130090125084120090122090	115	132078130082132080132090130090
56	144096146094146096138098140098	116	124084124086122084120086122076
57	146096134090130088132088130088	117	120064110064112066110068112070
58	120070118076112076112070110074	118	124080128076128074124076128078
59	140084134082128082134082132086	119	100068104070100068100068100070
60	122084120080120078120080118076	120	138082132084134084134082130082

7. Raw data for isometric rest-hamstrings-heart rate
Read 077; 080; 070; 082; 077; etc.

1	077080070082077	61	067068068074068
2	085083087078078	62	074070075078075
3	093058067060064	63	065057059068078
4	057050057054080	64	050058051054055
5	067075074080090	65	070069070067070
6	065052055054080	66	068073068080064
7	080065080072107	67	058056053060053
8	057057073057080	68	065057050058063
9	065067062060065	69	060065058056048
10	053062058053073	70	097107080087095
11	052060055050070	71	065065060068065
12	052051058057065	72	057050058052075
13	065065063063074	73	082074080077082
14	067073067065082	74	083082083092088
15	060060077058078	75	087052056046085
16	052048050053067	76	058057060055055
17	062070063070080	77	078073080075075
18	053060055052087	78	055053053052059
19	060070055060070	79	093064078070077
20	045052057047065	80	067058058058070
21	043050053062045	81	067066073065065
22	083085097085100	82	066067057072068
23	070070065065075	83	053052053054058
24	063055060060065	84	062062053054057
25	090097078077080	85	077060065068068
26	086083086078085	86	067062062067068
27	060065059050070	87	084052070065080
28	065057065060070	88	047051052058060
29	065060078073068	89	070078075077068
30	063060062048061	90	063055060057060
31	084082080073095	91	053055055055048
32	075065068063080	92	083055055056057
33	065067060068065	93	063048060055070
34	070075075065063	94	089093090095093
35	060060070067086	95	065070072063070
36	050053053052055	96	053067053055053
37	063068066066060	97	077090077064080
38	067068072075087	98	080078085075076
39	073074070058088	99	068064074065064
40	070067070058080	100	057060057062053
41	065077066070072	101	082080080075082
42	077060077055078	102	050057053050050
43	043060060055068	103	088078078067073
44	048046055047075	104	065060062063055
45	060050073055067	105	073065068065063
46	095093083102105	106	070055060057057
47	066065064065068	107	066068065065065
48	058065055068070	108	060055059056065
49	087077072077080	109	070070070063078
50	093082090080080	110	072068070069068
51	055065058065072	111	072060078060080
52	062055062057055	112	050053052055055
53	080075075090062	113	065067065072068
54	055053050063065	114	060070073062065
55	073083078080074	115	070075075080070
56	061058062055058	116	053067042066055
57	065073063060073	117	053050075052055
58	060060055060072	118	115095103093100
59	055050055055087	119	067063067065065
60	065068055068068	120	055065053063055

8. Raw data for isometric rest-hamstrings-blood pressure

Read 120/084 (systolic/diastolic); 116/084;
118/084; etc.

1	120084116084118084130086124088	61	120078114084114080112080110080
2	110084118090112090116092120096	62	124082122088120084118086122088
3	130090130092128090128090130090	63	140072136072136072124070132070
4	130092128084130090130088130092	64	124086124080120078118080120078
5	130094120096118092120090120096	65	140096132096130100130100132100
6	115068115088118070118070120068	66	140074120076116076118074118080
7	118084120080120084120084128088	67	148090140086136088132088132086
8	122096120096130100130100130104	68	124076122088120084118084118086
9	130096128096128096126094126098	69	120058110066110068110060112066
10	118076116076112076110072110074	70	118074122076118076118070112068
11	136090132090130086130088132090	71	108070104070104068104070104068
12	116078110080110080110080110082	72	140086146082132080134078136082
13	118084118084118082116080114084	73	126108120090120088122096120092
14	122084120086118088120088122088	74	110090110088112092108090112090
15	122076122076124076122080124076	75	130088120090126088120088120090
16	112084112084112084110080112086	76	130094130090128088130088128090
17	122090124092126094124096124096	77	130090120092120090118088122088
18	110076110074108070110070112074	78	128076110078118080120076112084
19	120096118092124096124096126096	79	118088118080118090118086120078
20	118080120084118086118086118086	80	148104138100138098140092140100
21	104068104070104068104066104066	81	132100130096130096128098130098
22	112078112080110078112080114078	82	112084110076112080110080110080
23	106070106068104070104070104070	83	140084140080140078132078134080
24	120080120080120080124084124084	84	118080120082118084118080118084
25	128090130088126088120088118084	85	124086120086118084114084112084
26	115090130090124092120084120096	86	118088118092118090118088118090
27	120090124090120088122090120094	87	136078120078120078126076120072
28	130088120080124088126090124090	88	112076110076112080112080112080
29	124092124088130088122090120090	89	132100124100122100126100130100
30	150090132078140070140070138070	90	118080118080120076114078118078
31	115090118084118084124080120088	91	130090130088130088130090130090
32	142096138096138096138100140096	92	118070118076118078112080112080
33	132098130098130096130098132098	93	122056120070115068115070110068
34	120074112074110074110076110076	94	112076112074110074110076110076
35	140083130080130084128084128084	95	110068112064112068104076108074
36	114080110078108078108078108080	96	140080138080132080136082132086
37	110082110080112080110080108080	97	120094116090120090118088116096
38	112080112080112084110084110084	98	116084112080104088116084112084
39	140070138064136070126078126068	99	130090128088120090120084120088
40	110076112080114084114080110084	100	138090128092126086130090130092
41	134090132092130094132094134096	101	118090110088118082116088110082
42	140082118080118080114080110078	102	118080110076120076116076118080
43	128090126090130090128088130090	103	128080128080128084124080124080
44	142070128076120080120088118080	104	144098140100140098140110140094
45	104066106072106070108066104068	105	128098132096132098130096130098
46	112078108078110080108080110080	106	108084108078108076102070108070
47	104064104064104068106068106068	107	140084142084140082130080130080
48	130080130088130082132088128084	108	112070110078108082108080108080
49	132100126098120084122092120088	109	118086116086116084116082114082
50	118084124090120092112088110096	110	124084120090120090118092118088
51	130090120080138094128090128090	111	124080112080112076116078112076
52	138088140088136090128090132086	112	122080120080120082116080112078
53	132098120094120088118090120090	113	138092138100136098132094132090
54	138088120072124068120070116076	114	114074116074118076114076114076
55	120096120094118086120080122084	115	138080138090130092128092132092
56	140096138090142096138096138092	116	120084116080118082118080114082
57	132098138090134100136094136094	117	122068108072102068104066104068
58	110070110076110080110078110070	118	138074128076120074114072108076
59	138076136084130080132076132076	119	100070104076104072102068104070
60	118078116082112080110080110080	120	134070132088132080130078130082

9. Raw data for isometric exercise-quadriceps-heart
rate

Read 110; 087; 078; 090; etc.

1	110087078090
2	132130110090
3	080075075066
4	107120062058
5	113123095070
6	140096072060
7	150133092090
8	101117080060
9	112112087072
10	095093079060
11	132122085065
12	108100087058
13	115122098073
14	113087072066
15	133138093074
16	117118082075
17	090104076065
18	160145102085
19	125105065056
20	115125080047
21	133128095052
22	174181110106
23	090095085063
24	140100080060

END OF FILE

10. Raw data for isometric exercise-quadriceps-blood pressure

Read 140/110 (systolic/diastolic); 130/100;
120/88; etc.

```

1      140110130100120088136100
2      134110140100152110128100
3      168110150110158124148096
4      180138190120160110142096
5      160110160120142110130096
6      184110182108148088140080
7      150110155128142100144090
8      170130170115158120146098
9      162120150115150100136108
10     150118160106122100116074
11     190130192124160110140084
12     150098148110128088120084
13     150094142100144092128086
14     152104142104136090122090
15     160110166116140096134084
16     160124148114130090120090
17     154120160120140104130096
18     160120160122136104124090
19     172124115108148090130094
20     210140178110140110130084
21     150116150118124090118072
22     152090143092134102130092
23     132100132090120078108076
24     172130164115136090136086
END OF FILE

```


11. Raw data for isometric exercise-hamstrings-
heart rate

Read 100; 096; 085; 085; etc.

1	100096085085
2	124095085087
3	082063070073
4	108105058055
5	135098080076
6	135076065062
7	150147088078
8	115089070063
9	105105073065
10	098087067060
11	108122078058
12	124092075072
13	093093080070
14	087087077076
15	150138086081
16	124125065055
17	080078066073
18	130110067060
19	125085050043
20	103100063063
21	117118078055
22	155145100094
23	094082066062
24	116103082063

END OF FILE

12. Raw data for isometric exercise-hamstrings-
 blood pressure
 Read (140/110 (systolic/diastolic); 142/110;
 etc.

1	140110142110138098132096
2	148120120096128084112088
3	162112170120140096126090
4	170138160130144092130090
5	150120122100128096120090
6	180110155096140084125080
7	140115155110144100128092
8	180118150110150098142096
9	155112160112136102132096
10	142092140110122084110084
11	168110160118150090136084
12	148114132090126072120078
13	168120128092128084120088
14	148102126106122088118086
15	190138168130138088122082
16	156130150110128090118084
17	160128140100142098136098
18	170092142098124080118072
19	170122142100140088130090
20	152120155130138094118084
21	178110152108130080110068
22	150100136096118080112078
23	142110124084112070108074
24	170130152110150096140088

END OF FILE

13. Raw data for isokinetic rest
 - (a) mean blood pressure (V28-V36)
 - (b) modified tension time index (V37-V45)
 - (c) pulse pressure (V46-V54)

1	130. 88. 130. 86. 130. 90. 140. 78. 132. 84. 130. 88. 138. 78. 134. 80. 126. 86. 62. 58. 60. 75. 63. 65. 73. 65. 70. 101. 90
	100. 57 103. 23 98. 57 99. 90 101. 90 97. 90 97. 90 99. 23 80. 60 75. 40 78. 00 105. 00 83. 16 84. 50 100. 74 87. 10 88.
2	20 42. 00 44. 00 40. 00 62. 00 48. 00 42. 00 60. 00 54. 00 40. 00
	140. 70. 142. 82. 130. 86. 136. 84. 128. 88. 128. 86. 126. 86. 130. 86. 130. 86. 70. 60. 67. 65. 68. 61. 59. 62. 62. 93. 24
	101. 90 100. 57 101. 23 101. 23 99. 90 99. 23 100. 57 100. 57 98. 00 85. 20 87. 10 88. 40 87. 04 78. 08 74. 34 80. 60 80
3	60 70. 00 60. 00 44. 00 52. 00 40. 00 42. 00 40. 00 44. 00 44. 00
	115. 78. 112. 80. 114. 80. 130. 74. 130. 78. 128. 70. 140. 70. 124. 76. 122. 76. 62. 65. 67. 85. 75. 75. 83. 68. 75. 90. 24
	90. 58 91. 24 92. 57 95. 24 89. 24 93. 24 91. 91 91. 24 91. 24 71. 30 72. 80 76. 38 110. 50 97. 50 96. 00 116. 20 84. 32 91.
4	50 37. 00 32. 00 34. 00 56. 00 52. 00 58. 00 70. 00 48. 00 46. 00
	136. 76. 130. 74. 122. 76. 120. 78. 122. 76. 122. 76. 120. 80. 120. 80. 118. 80. 83. 75. 70 70 78. 73. 65. 60. 72. 95. 90
	92. 57 91. 24 91. 91 91. 24 91. 24 93. 24 93. 24 92. 57 112. 88 97. 50 85. 40 84. 00 99. 16 89. 06 78. 00 72. 00 84.
5	96 60. 00 56. 00 46. 00 42. 00 46. 00 46. 00 40. 00 40. 00 38. 00
	110. 78. 112. 76. 112. 78. 132. 68. 118. 76. 115. 76. 132. 76. 128. 76. 138. 76. 60. 63. 65. 75. 65. 70. 78. 73. 72. 88. 58
	87. 91 89. 24 89. 24 89. 91 88. 91 94. 57 93. 24 96. 57 66. 00 70. 56 72. 80 89. 00 76. 70 80. 50 102. 96 93. 44 99.
6	36 32. 00 36. 00 34. 00 64. 00 42. 00 39. 00 56. 00 52. 00 62. 00
	144. 68. 136. 78. 128. 74. 128. 76. 124. 80. 124. 76. 124. 76. 120. 76. 118. 70. 80. 74. 58. 74. 72. 74. 70. 70. 76. 93. 24
	97. 24 91. 91 93. 24 94. 57 91. 91 91. 91 90. 58 85. 91 115. 20 100. 64 87. 04 94. 72 89. 28 91. 76 86. 80 84. 00 89.
7	68 76. 00 58. 00 54. 00 52. 00 44. 00 48. 00 48. 00 44. 00 48. 00
	120. 78. 118. 80. 118. 80. 152. 68. 140. 70. 132. 74. 158. 70. 140. 76. 138. 78. 65. 73. 67. 75. 62. 110. 102. 93. 100. 91. 91
	92. 57 92. 57 95. 90 93. 24 93. 24 99. 23 97. 24 97. 90 78. 00 86. 14 79. 06 114. 00 86. 80 145. 20 161. 16 130. 20 138.
8	00 42. 00 38. 00 38. 00 84. 00 70. 00 58. 00 88. 00 64. 00 60. 00
	164. 70. 142. 76. 132. 76. 132. 80. 132. 78. 128. 78. 122. 76. 118. 74. 122. 70. 96. 75. 90. 80. 90. 85. 80. 90. 90. 101. 23
	97. 90 94. 57 97. 24 95. 90 94. 57 91. 24 88. 58 87. 25 157. 44 106. 50 118. 80 105. 60 118. 80 108. 80 97. 60 106. 20 109.
9	80 94. 00 66. 00 56. 00 52. 00 54. 00 50. 00 46. 00 44. 00 52. 00
	120. 86. 120. 86. 120. 86. 164. 76. 150. 78. 136. 80. 172. 74. 150. 80. 148. 78. 58. 60. 60. 60. 60. 95. 60. 63. 95. 97. 24
	97. 24 97. 24 105. 23 101. 90 98. 57 106. 56 103. 23 101. 23 69. 60 72. 00 72. 00 98. 40 90. 00 129. 20 103. 20 94. 50 140.
10	60 34. 00 34. 00 88. 00 72. 00 56. 00 98. 00 70. 00 70. 00
	180. 68. 168. 72. 140. 80. 136. 78. 130. 76. 132. 76. 128. 72. 120. 80. 122. 80. 90. 83. 68. 85. 70. 80. 80. 73. 80. 105. 23
	103. 90 99. 90 97. 24 93. 91 94. 57 90. 58 93. 24 93. 91 162. 00 139. 44 95. 20 115. 60 91. 00 105. 60 102. 40 87. 60 97.
11	60 112. 00 96. 00 60. 00 58. 00 54. 00 56. 00 56. 00 40. 00 42. 00
	126. 88. 126. 88. 120. 88. 152. 80. 142. 86. 140. 80. 178. 76. 164. 86. 150. 88. 64. 60. 60. 83. 75. 95. 115. 87. 115. 100. 57
	100. 57 98. 57 103. 90 104. 56 99. 90 109. 89 111. 89 108. 56 80. 64 75. 60 72. 00 126. 16 106. 50 133. 00 204. 70 142. 68 172.
12	50 38. 00 38. 00 32. 00 72. 00 56. 00 60. 00 102. 00 78. 00 62. 00
	184. 72. 156. 86. 152. 88. 140. 88. 130. 84. 130. 80. 130. 82. 128. 80. 120. 80. 95. 97. 92. 90. 85. 90. 76. 87. 95. 109. 22
	109. 22 109. 22 105. 23 99. 23 96. 57 97. 90 95. 90 93. 24 174. 80 151. 32 139. 84 126. 00 110. 50 117. 00 98. 80 111. 36 114.
13	00 112. 00 70. 00 64. 00 52. 00 46. 00 50. 00 48. 00 48. 00 40. 00
	130. 82. 128. 84. 130. 80. 160. 90. 140. 88. 142. 88. 178. 92. 158. 88. 158. 88. 57. 55. 55. 70. 65. 80. 74. 65. 73. 97. 90
	98. 57 96. 57 113. 22 105. 23 105. 89 120. 55 111. 22 111. 22 74. 10 70. 40 71. 50 112. 00 91. 00 113. 60 131. 72 102. 70 115.
14	34 48. 00 44. 00 50. 00 70. 00 52. 00 54. 00 86. 00 70. 00 70. 00
	190. 76. 160. 82. 148. 84. 142. 88. 142. 84. 132. 82. 138. 88. 130. 88. 130. 88. 70. 60. 65. 57. 62. 61. 70. 58. 60. 113. 89
	107. 89 105. 23 105. 89 103. 23 98. 57 104. 56 101. 90 101. 90 133. 00 96. 00 96. 20 80. 94 88. 04 80. 52 96. 60 75. 40 78.
15	00 114. 00 78. 00 64. 00 54. 00 58. 00 50. 00 50. 00 42. 00 42. 00
	120. 88. 118. 88. 120. 90. 172. 80. 160. 80. 142. 82. 182. 84. 166. 88. 154. 88. 54. 48. 58. 70. 65. 63. 75. 72. 72. 98. 57
	97. 90 99. 90 110. 56 106. 56 101. 90 116. 55 113. 89 109. 89 64. 80 56. 64 69. 60 120. 40 104. 00 89. 46 136. 50 119. 52 110
16	88 32. 00 30. 00 92. 00 80. 00 60. 00 88. 00 78. 00 66. 00
	182. 88. 160. 86. 148. 88. 146. 88. 138. 88. 138. 80. 136. 88. 134. 88. 130. 90. 72. 70. 73. 60. 62. 65. 60. 59. 62. 119. 21
	110. 56 107. 89 107. 23 104. 56 105. 89 103. 90 103. 23 103. 23 131. 04 112. 00 108. 04 87. 60 85. 56 89. 70 81. 60 79. 06 80.
17	60 94. 00 74. 00 60. 00 58. 00 50. 00 48. 00 48. 00 46. 00 40. 00
	124. 90. 126. 92. 128. 90. 170. 80. 156. 90. 150. 90. 190. 88. 170. 92. 170. 90. 52. 55. 52. 75. 62. 70. 70. 70. 85. 101. 23
	103. 23 102. 56 109. 89 111. 89 109. 89 121. 88 117. 88 116. 55 64. 48 69. 30 66. 56 127. 50 96. 72 105. 00 133. 00 119. 00 144.
18	50 34. 00 34. 00 90. 00 66. 00 60. 00 102. 00 78. 00 80. 00
	190. 92. 170. 90. 152. 90. 142. 88. 142. 88. 142. 88. 138. 86. 132. 88. 132. 82. 97. 68. 62. 70. 70. 68. 60. 65. 62. 124. 54
	116. 55 110. 56 105. 89 103. 23 105. 89 103. 23 102. 56 98. 57 184. 30 115. 60 94. 24 99. 40 99. 40 96. 56 82. 80 85. 80 81.
19	84 98. 00 80. 00 62. 00 54. 00 58. 00 54. 00 52. 00 44. 00 50. 00
	125. 68. 124. 68. 124. 68. 168. 40. 146. 60. 148. 60. 162. 40. 158. 60. 150. 60. 50. 55. 55. 70. 58. 83. 65. 67. 82. 86. 91
	86. 58 86. 58 82. 58 88. 58 94. 57 80. 59 92. 57 89. 91 62. 50 68. 20 68. 20 117. 60 84. 68 122. 84 105. 30 105. 86 123.
20	00 57. 00 56. 00 56. 00 128. 00 86. 00 80. 00 122. 00 98. 00 90. 00
	160. 52. 148. 60. 140. 60. 136. 60. 136. 62. 128. 62. 128. 68. 128. 62. 128. 66. 73. 56. 60. 65. 54. 53. 61. 62. 58. 87. 91
	89. 24 86. 58 85. 25 86. 58 83. 92 87. 91 83. 92 86. 58 116. 80 82. 88 84. 00 88. 40 73. 44 67. 84 78. 08 79. 36 74.

21	24	108.00	88.00	80.00	76.00	74.00	66.00	60.00	66.00	62.00	130.	76.132.	82.132.	80.170.	20.170.	20.170.	25.178.	10.178.	15.174.	15.44.	35.55.	80.80.	95.105.	90.110.	93.91.
		98.57	97.24	69.93	69.93	73.26	65.93	69.26	67.93	57.20	46.20	72.60	136.00	136.00	161.50	186.90	160.20	191.							
22	40	54.00	50.00	52.00	150.00	150.00	145.00	168.00	163.00	159.00	178.	10.166.	15.160.	30.156	50.152.	56.150.	56.142.	58.140.	64.140.	66.100.	87.78	76.75.	75.74.	76.73.	65.93
		65.27	73.26	85.25	87.91	87.25	85.91	89.24	90.58	178.00	144.42	124.80	118.56	114.00	112.50	105.08	106.40	102.							
23	20	168.00	151.00	130.00	106.00	96.00	94.00	84.00	76.00	74.00	128.	80.130.	80.130.	78.156.	50.144.	54.120.	66.160.	42.158.	40.148.	42.57.	43.44.	62.61.	54.73.	68.78.	95.90
		96.57	95.24	85.25	83.92	83.92	81.25	79.25	77.26	72.96	55.90	57.20	96.72	87.84	64.80	116.80	107.44	115.							
24	44	48.00	50.00	52.00	106.00	90.00	54.00	118.00	118.00	106.00	170.	10.152.	44.148.	50.144.	50.138.	60.140.	66.136.	70.132.	70.130.	72.87.	73.70.	72.65.	62.63.	70.68.	63.27
		79.92	82.58	81.25	85.91	90.58	91.91	90.58	91.24	147.90	110.96	103.60	103.68	89.70	86.80	85.68	92.40	88.							
25	40	160.00	108.00	98.00	94.00	78.00	74.00	66.00	62.00	58.00	112.	80.116.	78.114.	76.120.	76.120.	72.124.	80.136.	64.120.	70.120.	70.54.	58.58.	73.70.	60.98.	60.75.	90.58
		90.58	88.58	90.58	87.91	94.57	87.91	86.58	60.48	67.28	66.12	87.60	84.00	74.40	133.28	72.00	90.								
26	00	32.00	38.00	38.00	44.00	48.00	44.00	72.00	50.00	50.00	158.	72.130.	72.122.	76.120.	76.120.	78.118.	78.112.	78.114.	76.112.	78.76.	72.73.	63.68.	65.65.	63.66.	100.57
		91.24	91.24	90.58	91.91	91.24	89.24	88.58	89.24	120.08	93.60	89.06	75.60	81.60	76.70	72.80	71.82	73.							
27	92	86.00	58.00	46.00	44.00	42.00	40.00	34.00	38.00	34.00	128.	82.126.	84.126.	84.138.	78.140.	84.136.	86.146.	80.138.	84.138.	80.53.	57.53.	83.72.	87.78.	69.78.	97.24
		97.90	97.90	97.90	102.56	101.90	101.90	99.23	67.84	71.82	66.78	114.54	100.80	118.32	113.88	95.22	107.								
28	64	46.00	42.00	42.00	60.00	56.00	50.00	66.00	54.00	58.00	148.	72.150.	72.132.	82.132.	84.134.	80.130.	82.130.	84.130.	84.128.	82.86.	75.97.	75.78.	68.70.	65.75.	97.24
		97.90	98.57	99.90	97.90	97.90	99.23	99.23	97.24	127.28	112.50	128.04	99.00	104.52	88.40	91.00	84.50	96.							
29	00	76.00	78.00	50.00	48.00	54.00	48.00	46.00	46.00	46.00	114.	76.116.	78.112.	78.148.	68.128.	70.132.	78.148.	68.140.	72.126.	84.55.	62.50.	83.68.	75.85.	75.88.	88.58
		90.58	89.24	94.57	89.24	95.90	94.57	94.57	97.90	62.70	71.92	56.00	122.84	87.04	99.00	125.80	105.00	110.							
30	88	38.00	38.00	34.00	80.00	58.00	54.00	80.00	58.00	42.00	148.	76.140.	70.140.	70.140.	72.138.	70.130.	70.128.	70.120.	70.120.	72.92.	94.90.	83.75.	65.72.	63.70.	99.90
		93.24	93.24	94.57	92.57	89.91	89.24	86.58	87.91	136.16	131.60	126.00	116.20	103.50	84.50	92.16	75.60	84.							
31	00	72.00	70.00	70.00	68.00	68.00	60.00	58.00	50.00	48.00	124.	100.126.	96.128.	100.164.	90.158.	84.136.	84.170.	84.150.	90.140.	92.56.	55.55.	65.55.	65.70.	63.65.	107.89
		105.89	109.22	114.55	108.56	101.23	112.55	109.89	107.89	69.44	69.30	70.40	106.60	86.90	88.40	119.00	94.50	91							
32	00	24.00	30.00	28.00	74.00	74.00	52.00	86.00	60.00	48.00	170.	88.150.	94.150.	94.146.	100.138.	96.140.	100.142.	98.142.	102.138.	100.72.	65.70.	70.70.	67.72.	73.65.	115.22
		112.55	112.55	115.22	109.89	113.22	112.55	115.22	112.55	122.40	97.50	105.00	102.20	96.60	93.80	102.24	103.66	89.							
33	70	82.00	56.00	56.00	46.00	42.00	40.00	44.00	40.00	38.00	122.	80.124.	88.122.	80.166.	76.150.	92.140.	80.160.	92.150.	90.152.	90.63.	58.70.	75.75.	75.95.	77.90.	93.91
		99.90	93.91	105.89	111.22	99.90	114.55	109.89	110.56	76.86	71.92	85.40	124.50	112.50	105.00	152.00	115.50	136.							
34	80	42.00	36.00	42.00	90.00	58.00	60.00	68.00	60.00	62.00	180.	90.160.	80.158.	84.152.	86.150.	86.148.	84.148.	84.138.	84.140.	88.93.	80.80.	83.80.	80.78.	80.78.	119.88
		106.56	108.56	107.89	107.23	105.23	105.23	101.90	105.23	167.40	128.00	126.40	126.16	120.00	118.40	115.44	110.40	109.							
35	20	90.00	80.00	74.00	66.00	64.00	64.00	64.00	54.00	52.00	130.	84.130.	86.130.	86.162.	82.160.	80.160.	80.177.	86.170.	80.162.	84.55.	60.50.	82.72.	80.90.	95.100.	99.23
		100.57	100.57	108.56	106.56	106.56	116.22	109.89	109.89	71.50	78.00	65.00	132.84	115.20	128.00	159.30	161.50	162.							
36	00	46.00	44.00	44.00	80.00	80.00	80.00	91.00	90.00	78.00	184.	80.170.	84.152.	88.150.	82.150.	86.150.	80.146.	86.144.	86.144.	84.103.	93.85.	84.85.	83.85.	85.82.	114.55
		112.55	109.22	104.56	107.23	103.23	105.89	105.23	103.90	189.52	158.10	129.20	126.00	127.50	124.50	124.10	122.40	118.							
37	08	104.00	86.00	64.00	68.00	64.00	70.00	60.00	58.00	60.00	116.	84.112.	88.112.	84.140.	72.138.	80.142.	88.142.	88.132.	80.132.	84.85.	90.73.	88.70.	70.75.	75.110.	94.57
		95.90	93.24	94.57	99.23	100.57	105.89	97.24	99.90	98.60	100.80	81.76	123.20	96.60	99.40	106.50	99.00	145.							
38	20	32.00	24.00	28.00	68.00	58.00	62.00	54.00	52.00	48.00	146.	82.142.	86.138.	90.130.	88.132.	88.128.	90.128.	90.124.	88.124.	88.77.	90.80.	77.75.	78.80.	73.74.	103.23
		104.56	105.89	101.90	102.56	102.56	102.56	99.90	99.90	112.42	127.80	110.40	100.10	99.00	99.84	102.40	90.52	91.							
39	76	64.00	56.00	48.00	42.00	44.00	38.00	38.00	36.00	36.00	122.	80.122.	80.120.	80.144.	64.140.	64.140.	60.158.	60.148.	80.144.	80.55.	55.80.	80.65.	107.70.	87.112.	93.91
		93.91	93.24	90.58	91.91	99.90	92.57	102.56	101.23	67.10	67.10	96.00	115.20	91.00	149.80	110.60	128.76	161.							
40	28	42.00	42.00	40.00	80.00	72.00	60.00	98.00	68.00	64.00	168.	60.140.	70.136.	70.136.	80.136.	78.132.	80.128.	80.126.	80.124.	80.75.	68.70.	75.78.	82.68.	85.85.	95.90
		93.24	91.91	98.57	97.24	97.24	95.90	95.24	94.57	126.00	95.20	102.00	106.08	108.24	87.04	107.10	105.								

38	74.00	68.00	58.00	48.00	50.00	44.00	36.00	36.00	36.00	38.00		
39	84.130	86.132	86.160	74.152	76.156	78.178	78.158	76.154	72.58	66.56	67.65	90.72.80.75.99.23
40	57.101.23	102.56	101.23	103.90	111.22	103.23	99.23	75.40	85.80	73.92	107.20	98.80.140.40.128.16.126.40.115
41	50.46.00	44.00	46.00	86.00	76.00	78.00	100.00	82.00	82.00			
42	178.76.162	80.144	82.142	80.142	74.140	74.138	68.134	70.134	70.90	85.75	78.80	80.82.83.84.109.89
43	107.23	102.56	100.57	96.57	95.90	91.24	91.24	160.20	137.70	108.00	110.76	113.60.112.00.113.16.111.22.112.
44	56.102.00	82.00	62.00	62.00	68.00	66.00	70.00	64.00	64.00			
45	116.74.116	74.118	76.150	62.150	70.138	66.174	60.160	64.154	70.45	47.60	78.65	90.75.75.95.87.91
46	87.91	89.91	91.24	96.57	89.91	97.90	95.90	97.90	52.20	54.52	70.80	117.00.97.50.124.20.130.50.120.00.146.
47	30.42.00	42.00	42.00	88.00	80.00	72.00	114.00	96.00	84.00			
48	182.70.160	72.150	72.146	70.134	66.132	68.134	74.132	74.130	70.85	85.83	87.83	78.83.83.80.107.23
49	101.23	97.90	95.24	88.58	89.24	93.91	93.24	89.91	154.70	136.00	124.50	127.02.111.22.102.96.111.22.109.56.104.
50	00.112.00	88.00	78.00	76.00	68.00	64.00	60.00	58.00	60.00			
51	130.84.128	86.128	86.166	72.152	76.150	86.180	52.166	80.156	80.42	44.45	68.82	90.89.80.88.99.23
52	99.90	99.90	103.23	101.23	107.23	94.57	108.56	105.23	54.60	56.32	57.60	112.88.124.64.135.00.160.20.132.80.137.
53	28.46.00	42.00	42.00	94.00	76.00	64.00	128.00	86.00	76.00			
54	174.72.150	80.146	76.142	76.134	72.130	70.124	70.122	70.124	70.100	90.90	80.78	83.80.80.80.105.89
55	103.23	99.23	97.90	92.57	89.91	87.91	87.25	87.91	174.00	135.00	131.40	113.60.104.52.107.90.99.20.97.60.99.
56	20.102.00	70.00	70.00	66.00	62.00	60.00	54.00	52.00	54.00			
57	118.82.122	84.120	80.156	80.132	88.130	88.144	80.134	82.134	80.86	82.86	98.98	90.95.90.90.93.91
58	96.57	93.24	105.23	102.56	101.90	101.23	99.23	97.90	101.48	100.04	103.20	152.88.129.36.117.00.136.80.120.60.120.
59	60.36.00	38.00	40.00	76.00	44.00	42.00	64.00	52.00	54.00			
60	158.84.142	88.140	88.140	88.136	88.132	86.130	86.130	84.126	84.103	90.95	95.88	100.100.101.85.108.56
61	105.89	105.23	105.23	103.90	101.23	100.57	99.23	97.90	162.74	127.80	133.00	133.00.119.68.132.00.130.00.131.30.107.
62	10.74.00	54.00	52.00	52.00	48.00	46.00	44.00	46.00	42.00			
63	120.88.120	88.122	88.138	84.136	86.132	86.154	84.140	82.140	84.65	70.75	97.85	90.100.80.97.98.57
64	98.57	99.23	101.90	102.56	101.23	107.23	101.23	102.56	78.00	84.00	91.50	133.86.115.60.118.80.154.00.112.00.135.
65	80.32.00	32.00	34.00	54.00	50.00	46.00	70.00	58.00	56.00			
66	156.88.140	88.140	86.138	82.130	84.130	82.126	84.120	84.124	86.100	85.87	87.92	85.85.95.90.110.56
67	105.23	103.90	100.57	99.23	97.90	97.90	95.90	98.57	156.00	119.00	121.80	120.06.119.60.110.50.107.10.114.00.111.
68	60.68.00	52.00	54.00	56.00	46.00	48.00	42.00	36.00	38.00			
69	115.86.112	82.114	82.150	70.138	70.130	74.162	78.140	84.138	84.90	85.78	100.95	95.112.108.106.95.57
70	91.91	92.57	96.57	92.57	92.57	105.89	102.56	101.90	103.50	95.20	88.92	150.00.131.10.123.50.181.44.151.20.146.
71	28.29.00	30.00	32.00	80.00	68.00	56.00	84.00	56.00	54.00			
72	158.86.144	84.138	82.132	88.132	84.132	80.128	80.126	78.122	80.116	100.105	100.103	95.95.95.87.109.89
73	103.90	100.57	102.56	99.90	97.24	95.90	93.91	93.91	183.28	144.00	144.90	132.00.135.96.125.40.121.60.119.70.106.
74	14.72.00	60.00	56.00	44.00	48.00	52.00	48.00	48.00	42.00			
75	120.84.118	84.118	84.146	70.140	76.138	74.140	64.132	70.120	70.63	65.60	58.60	65.63.65.70.95.90
76	95.24	95.24	95.24	97.24	95.24	89.24	90.58	86.58	75.60	76.70	70.80	84.68.84.00.89.70.88.20.85.80.84.
77	00.36.00	34.00	34.00	76.00	64.00	64.00	76.00	62.00	50.00			
78	142.64.125	73.122	78.118	76.118	76.124	80.120	80.118	80.118	80.67	62.68	65.70	65.66.70.65.89.91
79	90.24	92.57	89.91	94.57	93.24	92.57	92.57	95.14	77.50	82.96	76.70	82.60.80.60.79.20.82.60.76.
80	70.78.00	52.00	44.00	42.00	42.00	44.00	40.00	38.00	38.00			
81	116.74.116	76.116	70.132	40.126	58.126	60.160	40.134	50.130	56.82	80.80	90.80	80.70.85.90.87.91
82	89.24	85.25	70.60	80.59	81.92	79.92	77.92	80.59	95.12	92.80	92.80	118.80.100.80.100.80.112.00.113.90.117
83	00.42.00	40.00	46.00	92.00	68.00	66.00	120.00	84.00	74.00			
84	150.48.142	56.136	60.130	60.122	62.120	60.120	70.118	68.110	72.90	95.80	90.80	87.85.77.70.81.92
85	84.58	85.25	83.25	81.92	79.92	86.58	84.58	84.58	135.00	134.90	108.80	117.00.97.60.104.40.102.00.90.86.77.
86	00.102.00	86.00	76.00	70.00	60.00	60.00	50.00	50.00	38.00			
87	120.84.120	84.120	84.138	62.136	70.130	78.138	46.124	66.124	76.62	66.66	78.58	70.77.70.85.95.90
88	95.90	95.90	87.25	91.91	95.24	76.59	85.25	91.91	74.40	79.20	79.20	107.64.78.88.91.00.106.26.86.80.105.
89	40.36.00	36.00	36.00	76.00	66.00	52.00	92.00	58.00	48.00			
90	138.50.136	60.136	68.130	70.120	70.120	74.116	78.112	80.110	80.84	83.72	87.67	70.70.72.80.79.25
91	85.25	90.58	89.91	86.58	89.24	90.58	90.58	89.91	115.92	112.88	97.92	113.10.80.40.84.00.81.20.80.64.88.
92	00.88.00	76.00	68.00	60.00	50.00	46.00	38.00	32.00	30.00			
93	110.78.108	78.104	78.124	80.118	80.114	80.138	78.126	80.120	82.45	48.47	53.47	70.63.71.70.88.58
94	87.91	86.58	94.57	92.57	91.24	97.90	95.24	94.57	49.50	51.84	48.88	65.72.55.46.79.80.86.94.89.46.84.
95	00.32.00	30.00	26.00	44.00	38.00	34.00	60.00	46.00	38.00			
96	136.70.132	80.132	78.128	78.122	72.122	78.122	80.120	80.116	80.65	55.50	60.55	55.60.55.55.91.91
97	97.24	95.90	94.57	88.58	92.57	93.91	93.24	91.91	88.40	72.60	66.00	76.80.67.10.73.20.66.00.63.

141	70	90.00	66.00	64.00	62.00	56.00	50.00	48.00	48.00	48.00	40.00	87.25
	110.	76.112.	70.114.	70.150.	56.134.	62.130.	64.160.	30.148.	58.132.	60.85.	70.75.	112.87.
	83.92	84.58	87.25	85.91	85.91	73.26	87.91	83.92	93.50	78.40	85.50	168.00
	16	34.00	42.00	44.00	94.00	72.00	66.00	130.00	90.00	72.00		
142	160.	40.144.	56.116.	60.112.	64.112.	70.112.	70.114.	70.114.	70.114.	70.112.	68.124.	107.93.
	85.25	78.59	79.92	83.92	83.92	84.58	84.58	82.58	198.40	154.08	107.88	112.00
	80	120.00	88.00	56.00	48.00	42.00	42.00	44.00	44.00	44.00		
143	116.	74.116.	70.118.	76.168.	20.154.	50.138.	60.174.	60.155.	62.155.	64.76.	53.60.	120.108.
	85.25	89.91	69.26	84.58	85.91	97.90	92.91.	94.24	88.16	61.48	70.80	201.60
	65	42.00	46.00	42.00	148.00	104.00	78.00	114.00	93.00	91.00		
144	178.	40.155.	45.140.	68.140.	68.134.	68.122.	68.120.	66.116.	64.116.	68.140.	112.108.	107.105.
	81.58	91.91	91.91	89.91	85.91	83.92	81.25	83.92	249.20	173.60	151.20	149.80
	00	138.00	110.00	72.00	72.00	66.00	54.00	54.00	52.00	48.00		

14. Raw data for isokinetic exercise
 - (a) mean blood pressure (V37-V48)
 - (b) modified tension time index (V49-V60)
 - (c) pulse pressure (V61-V72)

1	130.88.210.66.200.72.189.60.114.79.180.56.180.50.172.50.111.77.150.60.150.64.170.58.60.104.102.100.65.115.112.118.63.112.112.115.10.90.113.89.114.55.102.90.90.58.97.24.93.24.90.58.88.24.89.91.92.57.95.24.78.00.218.40.204.00.189.00.74.10.207.00.201.60.202.96.69.93.168.00.168.00.195.50.42.00.144.00.128.00.128.00.35.00.124.00.130.00.122.00.34.00.90.00.86.00.112.00.
2	119.79.164.54.190.52.180.50.120.86.180.58.176.58.172.50.125.88.170.72.190.64.185.64.60.145.155.160.68.153.160.165.61.153.160.169.92.24.90.58.97.90.93.24.97.24.98.57.97.24.90.58.100.23.104.56.105.89.104.23.71.40.237.80.294.50.288.00.81.60.275.40.281.60.283.80.76.25.260.10.304.00.312.65.40.00.110.00.138.00.130.00.34.00.122.00.118.00.122.00.37.00.98.00.126.00.121.00.
3	129.82.210.68.210.70.210.74.120.89.180.76.210.68.220.72.127.91.210.55.220.64.220.68.56.132.138.144.53.140.140.150.53.138.147.150.97.57.115.22.116.55.119.21.99.23.110.56.115.22.121.21.102.90.106.56.115.88.118.55.72.24.277.20.289.80.302.40.63.60.252.00.294.00.330.00.67.31.289.80.323.40.330.00.47.00.142.00.140.00.136.00.31.00.104.00.142.00.148.00.36.00.155.00.156.00.152.00.
4	126.68.198.10.198.10.190.8.132.79.190.25.180.5.128.80.190.30.205.10.200.5.55.130.138.128.46.135.150.149.47.120.131.143.87.25.72.59.72.59.68.60.96.57.79.92.66.60.62.60.95.90.83.25.74.92.69.93.69.30.257.40.273.24.243.20.60.72.256.50.270.00.265.22.60.16.228.00.268.55.286.00.58.00.188.00.188.00.182.00.53.00.165.00.170.00.173.00.48.00.160.00.195.00.195.00.
5	113.77.160.48.160.40.190.40.127.85.180.62.170.56.200.60.113.79.170.45.170.45.160.50.56.137.145.150.55.140.150.143.54.150.155.162.88.91.85.25.79.92.89.91.98.90.101.23.93.91.106.56.90.24.86.58.86.58.86.58.63.28.219.20.232.00.285.00.69.85.252.00.255.00.286.00.61.02.255.00.263.50.259.20.36.00.112.00.120.00.150.00.42.00.118.00.114.00.140.00.34.00.125.00.125.00.110.00.
6	126.99.170.60.180.58.180.68.122.84.190.68.190.48.190.45.130.85.180.60.175.45.192.50.57.110.115.125.64.137.150.148.53.130.139.127.107.89.96.57.98.57.105.23.96.57.108.56.95.24.93.24.99.90.99.90.88.24.97.24.71.82.187.00.207.00.225.00.78.08.260.30.285.00.281.20.68.90.234.00.243.25.243.84.27.00.110.00.122.00.112.00.38.00.122.00.142.00.145.00.45.00.120.00.130.00.142.00.
7	114.85.190.60.192.64.189.58.121.80.170.50.180.40.210.38.119.90.180.44.182.40.176.38.83.115.123.137.66.115.118.130.80.135.140.140.94.57.103.23.106.56.101.56.93.57.89.91.86.58.95.24.99.57.89.24.87.25.83.92.94.62.218.50.236.16.258.93.79.86.195.50.212.40.273.00.95.20.243.00.254.80.246.40.29.00.130.00.128.00.131.00.41.00.120.00.140.00.172.00.29.00.136.00.142.00.138.00.
8	118.82.160.64.160.52.148.60.118.84.170.68.168.70.170.62.118.82.180.62.168.55.170.60.59.113.115.128.74.150.158.150.60.135.142.150.93.91.95.90.87.91.89.24.95.24.101.90.102.56.97.90.93.91.101.23.92.57.96.57.69.62.180.80.184.00.189.44.87.32.255.00.265.44.255.00.70.80.243.00.238.56.255.00.36.00.96.00.108.00.88.00.34.00.102.00.98.00.108.00.36.00.118.00.113.00.110.00.
9	135.93.150.68.155.76.160.72.127.97.170.62.180.72.178.70.127.96.170.76.184.82.190.78.69.135.143.147.73.132.140.148.70.127.140.167.106.89.95.24.102.23.101.23.106.89.97.90.107.89.105.89.106.23.107.23.115.88.115.22.93.15.202.50.221.65.235.20.92.71.224.40.252.00.263.44.88.90.215.90.257.60.317.30.42.00.82.00.79.00.88.00.30.00.108.00.108.00.108.00.31.00.94.00.102.00.112.00.
10	112.65.198.56.164.50.166.60.110.76.156.64.184.56.180.68.106.75.152.68.170.66.170.54.61.118.125.135.60.128.140.145.60.135.145.152.80.59.103.23.87.91.95.24.87.25.94.57.98.57.105.23.85.25.95.90.100.57.92.57.68.32.233.64.205.00.224.10.66.00.199.68.257.60.261.00.63.60.205.20.246.50.258.40.47.00.142.00.114.00.106.00.34.00.92.00.128.00.112.00.31.00.84.00.104.00.116.00.
11	131.85.188.58.192.72.194.68.117.74.180.45.192.28.194.28.129.86.168.48.188.32.190.35.59.120.142.146.52.134.150.153.44.142.153.160.100.23.101.23.111.89.109.89.88.24.89.91.82.58.83.25.100.23.87.91.83.92.86.58.77.29.225.60.272.64.283.24.60.84.241.20.288.00.296.82.56.76.238.56.287.64.304.00.46.00.130.00.120.00.126.00.43.00.135.00.164.00.166.00.43.00.120.00.156.00.155.00.
12	121.83.190.50.190.45.190.50.123.88.168.72.192.72.196.58.114.84.160.38.179.40.172.40.83.135.126.140.70.116.120.125.81.144.148.153.95.57.96.57.93.24.96.57.99.57.103.90.111.89.103.90.93.91.78.59.86.25.83.92.100.43.256.50.239.40.266.00.86.10.194.88.230.40.245.00.92.34.230.40.264.92.263.16.38.00.140.00.145.00.140.00.35.00.96.00.120.00.138.00.30.00.122.00.139.00.132.00.
13	119.84.168.54.170.45.168.48.117.72.158.25.158.10.170.15.120.87.160.38.168.28.160.30.63.90.113.112.80.130.135.142.65.125.133.135.95.57.91.91.86.58.87.91.69.26.59.27.66.60.97.90.78.59.74.59.73.26.74.97.151.20.192.10.188.16.93.60.205.40.213.30.241.40.78.00.200.00.223.44.216.00.35.00.114.00.125.00.120.00.45.00.133.00.148.00.155.00.33.00.122.00.140.00.130.00.
14	108.78.164.70.170.68.168.64.106.76.150.48.170.52.158.48.109.81.168.55.160.60.160.60.47.108.133.142.49.142.145.157.51.140.150.157.87.91.101.23.101.90.98.57.85.91.81.92.91.24.84.58.90.24.92.57.93.24.93.24.50.76.177.12.226.10.238.56.51.94.213.00.246.50.248.06.55.59.235.20.240.00.251.20.30.00.94.00.102.00.104.00.30.00.102.00.118.00.110.00.28.00.113.00.100.00.100.00.
15	113.69.192.20.189.10.202.10.115.74.192.20.194.10.199.10.123.74.176.20.205.10.215.5.60.136.152.155.61.145.146.148.56.137.143.145.83.58.77.26.69.60.73.93.87.58.77.26.71.26.72.93.90.24.71.93.74.92.74.92.67.80.261.12.287.28.313.10.70.15.278.40.283.24.294.52.68.88.241.12.293.15.311.75.44.00.172.00.179.00.192.00.41.00.

16	172.00	184.00	189.00	49.00	156.00	195.00	210.00	116.78	205.72	205.55	210.60	117.78	170.50	172.64	178.40	117.83	170.60	180.40	190.50	52.140	152.153	53											
	143.150	152.52	150.160	90.58	116.22	104.89	109.89	90.91	89.91	99.90	85.91	94.24	96.57	86.58	96.57	60.32	287.00	311.60	321.30	62.01	243.10	258.00	270.56	60.84	255.00	288.00	304.00	38.00	133.00	150.00	150.00	39.00	
17	120.00	108.00	138.00	34.00	110.00	140.00	140.00	129.86	188.54	180.42	196.38	116.89	199.55	188.30	176.40	123.88	192.40	196.46	196.40	81.135	135.145	64											
	128.86	188.54	180.42	196.38	116.89	199.55	188.30	176.40	123.88	192.40	196.46	196.40	81.135	135.145	64.138	146.159	69.155	160.166	100.23	98.57	87.91	90.58	97.90	102.90	82.58	85.25	99.57	90.58	95.90	91.91	104.49		
	49.253	80.243	00.284	20.74	24.274	62.274	48.279	84.84	87.297	60.313	60.325	36.43	00.134	00.138	00.158	00.27	00.27	00.27	00.27	00.27	00.27	00.27	00.27	00.27	00.27	00.27	00.27	00.27	00.27	00.27	00.27	00.27	
18	144.00	158.00	136.00	35.00	152.00	150.00	156.00	113.81	160.54	164.38	158.15	113.77	158.25	150.20	158.40	107.78	144.40	148.30	152.25	52.162	174.183	70											
	113.81	160.54	164.38	158.15	113.77	158.25	150.20	158.40	107.78	144.40	148.30	152.25	52.162	174.183	70.76	259.20	285.36	289.14	79.10	304.94	307.50	327.06	68.48	263.52	281.20	293.36	32.00	106.00	126.00	143.00	36.00		
	193.205	207.64	183.190	193.91	57.89	24.79	92.62	60.88	91.69	26.63	27.79	25.87	58.74	59.69	26.67	27.58	76	259.20	285.36	289.14	79.10	304.94	307.50	327.06	68.48	263.52	281.20	293.36	32.00	106.00	126.00	143.00	36.00
19	133.00	130.00	118.00	29.00	104.00	118.00	127.00	115.85	148.40	152.30	158.20	127.89	146.45	160.30	170.30	117.88	158.35	160.25	158.20	42.125	142.142	53											
	115.85	148.40	152.30	158.20	127.89	146.45	160.30	170.30	117.88	158.35	160.25	158.20	42.125	142.142	53.123	136.138	44.133	143.153	94.90	75.92	70.60	65.93	101.56	78.59	73.26	76.59	97.57	75.92	69.93	65.93	48		
	30.185	00.215	84.224	36.67	31.179	58.217	60.234	60.51	48.210	14.228	80.241	74.30	00.108	00.122	00.138	00.30	185.00	215.84	224.36	67.31	179.58	217.60	234.60	51.48	210.14	228.80	241.74	30.00	108.00	122.00	138.00	38.00	
20	101.00	130.00	140.00	29.00	123.00	135.00	138.00	114.73	140.52	142.35	150.40	103.74	142.50	164.48	160.50	111.76	146.58	158.52	150.58	64.100	105.112	64											
	125.133	138.59	115.132	127.86	58.81	25.70	60.76	59.83	58.80	59.86	58.86	58.87	58.87	25.87	25.88	58.72	96	140.00	149.10	168.00	65.92	177.50	218.12	220.80	65.49	167.90	208.56	190.50	41.00	88.00	107.00	110.00	29.00
	92.00	116.00	110.00	35.00	88.00	106.00	92.00	112.84	170.15	182.5.190	5.190	83.83	182.20	186.10	192.10	110.81	190.24	198.15	210.15	43.143	155.162	49											
21	150.166	172.51	147.163	170.93	24.66	60.63	94.66	60.98	57.73	93.68	60.70	60.90	58.79	25.75	92.79	92.48	16	243.10	282.10	307.80	63.70	273.00	308.76	330.24	56.10	279.30	322.74	357.00	28.00	155.00	177.00	185.00	47.00
	162.00	176.00	182.00	29.00	166.00	183.00	195.00	106.72	162.40	158.42	158.32	109.68	140.30	145.30	158.20	113.84	170.10	178.10	178.10	84.165	174.195	85											
22	105.72	162.40	158.42	158.32	109.68	140.30	145.30	158.20	113.84	170.10	178.10	178.10	84.165	174.195	85.175	183.187	80.177	187.193	83.25	80.59	80.59	73.93	81.58	66.60	68.26	65.93	93.57	63.27	65.93	65.93	89		
	04.267	30.274	92.308	10.92	65.245	00.265	35.295	46.90	40.300	90.332	86.343	54.34	00.122	00.116	00.126	00.41	00.04	267.30	274.92	308.10	92.65	245.00	265.35	295.46	90.40	300.90	332.86	343.54	34.00	122.00	116.00	126.00	41.00
23	110.00	115.00	138.00	29.00	160.00	168.00	168.00	125.79	162.55	168.30	166.20	132.90	196.5.190	10.190	5.131	84.192	15.197	16.198	10.50	130.146	163.49												
	125.79	162.55	168.30	166.20	132.90	196.5.190	10.190	5.131	84.192	15.197	16.198	10.50	130.146	163.49.165	175.175	52.158	175.173	94.24	90.58	75.92	68.60	103.90	68.60	69.93	66.60	99.57	73.93	76.26	72.59	62.50			
	50.210	60.245	28.270	58.64	68.323	40.332	50.332	50.68.12	303.36	344.75	342.54	46.00	107.00	138.00	146.00	42.00	191.00	180.00	185.00	47.00	177.00	181.00	188.00										
24	114.84	140.25	148.10	152.20	113.73	155.10	168.5.168	10.116	74.162	10.170	10.174	10.105	163.185	190.77	180.187	193.63	186.190	195.93	91.63	27.55	94.63	94.86	25.58	27.62	60.87	91.60	61.63	27.64	60.119	70.228			
	70.228	20.273	80.288	80.87	01.279	00.314	16.324	24.73	08.301	32.323	00.339	30.30	00.115	00.138	00.132	00.40	145.00	163.00	158.00	42.00	152.00	160.00	164.00										

15. Raw data for isometric rest-quadriiceps
- (a) mean blood pressure (V16-V20)
 - (b) modified tension time index (V21-V25)
 - (c) pulse pressure (V26-V30)

1	122.82	122.84	120.84	118.90	170.90	70.87	80.78	80.95	24.96	57.96	90.99	23.99	90.85	40.106	14.96	00
2	92.04	96.00	40.00	38.00	36.00	28.00	30.00	77.75	95.90	94.57	96.57	99.23	99.90	81.60	86.40	91.50
3	120.84	120.82	122.84	122.88	120.88	120.90	68.72	75.57	95.90	94.57	96.57	99.23	99.90	81.60	86.40	91.50
4	93.94	90.00	36.00	38.00	38.00	34.00	30.00	57.75	98.57	99.23	97.90	99.23	99.90	74.40	76.86	80.24
5	120.88	122.88	118.88	118.90	120.90	62.63	68.52	75.52	103.90	99.90	95.90	107.23	105.89	76.56	66.00	66.56
6	67.26	90.00	32.00	34.00	30.00	28.00	30.00	65.62	103.23	101.23	101.90	103.23	108.56	81.90	74.40	84.42
7	132.90	132.84	128.80	130.96	130.94	58.50	52.52	60.55	89.91	88.58	89.91	95.90	89.91	60.50	60.50	61.36
8	67.60	97.50	42.00	48.00	48.00	34.00	36.00	82.65	95.90	105.23	96.57	91.91	101.90	96.00	105.60	97.94
9	130.90	124.90	126.90	126.92	126.92	63.60	67.70	70.62	113.22	113.89	113.22	113.89	115.22	98.00	96.56	98.00
10	88.20	81.90	40.00	34.00	36.00	34.00	26.00	59.80	102.56	101.90	101.23	102.56	102.56	76.88	76.86	74.40
11	110.80	110.78	118.76	120.84	118.84	55.55	52.55	62.80	86.58	87.25	85.25	87.25	85.25	62.40	71.02	65.96
12	66.00	70.80	30.00	32.00	42.00	36.00	42.00	67.75	95.90	98.57	95.90	95.90	99.90	76.80	83.20	80.64
13	120.84	120.98	118.86	120.78	122.92	80.88	83.65	70.53	89.24	87.25	87.25	88.58	93.24	56.00	55.00	55.00
14	78.00	100.04	36.00	22.00	32.00	42.00	30.00	80.85	95.24	97.90	97.24	96.57	99.23	70.80	70.80	78.00
15	140.100	142.100	140.100	142.100	146.100	70.68	70.62	67.67	97.24	97.24	95.90	95.90	95.90	72.80	81.76	81.76
16	88.04	102.20	40.00	42.00	40.00	42.00	46.00	75.85	85.25	84.58	89.24	91.24	85.25	52.72	71.82	67.28
17	124.92	122.92	124.90	124.92	124.92	63.60	63.60	62.80	86.58	87.25	85.25	87.25	85.25	62.40	71.02	65.96
18	73.16	99.20	32.00	30.00	34.00	32.00	32.00	67.75	95.90	98.57	95.90	95.90	99.90	76.80	83.20	80.64
19	104.78	106.78	108.74	110.76	104.76	60.67	62.62	70.53	89.24	87.25	87.25	88.58	93.24	56.00	55.00	55.00
20	68.20	83.20	26.00	28.00	34.00	34.00	28.00	80.85	95.24	97.90	97.24	96.57	99.23	70.80	70.80	78.00
21	128.80	128.84	128.80	128.80	128.80	65.63	63.67	67.75	95.90	98.57	95.90	95.90	95.90	74.40	96.20	75.24
22	85.76	96.00	48.00	44.00	48.00	48.00	42.00	70.53	89.24	87.25	87.25	88.58	93.24	56.00	55.00	55.00
23	58.30	78.40	34.00	34.00	34.00	32.00	28.00	80.85	95.24	97.90	97.24	96.57	99.23	70.80	70.80	78.00
24	118.84	118.88	120.86	118.86	122.86	60.60	65.65	67.67	97.24	97.24	95.90	95.90	95.90	72.80	81.76	81.76
25	94.40	103.70	34.00	30.00	34.00	32.00	34.00	75.85	85.25	84.58	89.24	91.24	85.25	52.72	71.82	67.28
26	112.90	112.90	112.88	112.88	112.88	65.73	73.68	75.85	85.25	84.58	89.24	91.24	85.25	52.72	71.82	67.28
27	76.16	75.04	22.00	22.00	24.00	24.00	24.00	85.85	89.91	85.91	89.91	89.24	93.91	63.80	53.00	91.30
28	112.72	114.70	116.76	114.80	116.80	56.53	58.75	70.53	99.90	105.89	106.56	107.23	110.56	74.40	96.20	75.24
29	85.50	98.60	40.00	44.00	40.00	34.00	46.00	70.53	87.91	89.91	92.57	90.58	91.91	78.40	60.50	82.60
30	110.80	106.76	110.80	108.80	114.84	58.50	83.54	85.85	103.23	102.56	102.56	102.56	102.56	81.90	71.68	71.68
31	58.32	96.90	30.00	30.00	30.00	28.00	30.00	70.53	95.24	95.24	95.90	95.90	95.90	49.50	60.50	50.40
32	120.90	130.94	132.94	134.94	136.94	62.74	57.70	62.62	90.58	87.25	89.24	88.58	89.91	97.44	93.50	93.96
33	93.80	102.00	30.00	36.00	38.00	40.00	38.00	70.53	87.91	89.91	92.57	90.58	91.91	78.40	60.50	82.60
34	112.76	110.80	118.80	116.80	116.80	55.70	70.64	62.62	103.23	102.56	102.56	102.56	102.56	81.90	71.68	71.68
35	81.20	74.24	36.00	30.00	38.00	38.00	36.00	70.53	95.24	95.24	95.90	95.90	95.90	49.50	60.50	50.40
36	126.92	128.90	128.90	128.90	128.90	56.56	62.62	40.80	96.57	95.24	95.90	95.90	95.90	59.40	65.72	69.12
37	79.36	79.36	34.00	38.00	38.00	38.00	38.00	50.60	82.58	79.25	81.25	82.58	83.25	59.40	65.72	69.12
38	110.90	110.88	112.88	112.88	112.88	45.55	45.40	87.87	90.58	87.25	89.24	88.58	89.91	97.44	93.50	93.96
39	44.80	83.60	20.00	22.00	24.00	24.00	24.00	70.53	80.59	79.92	79.92	79.92	81.25	63.60	63.44	74.88
40	108.70	106.66	108.68	108.70	110.70	55.62	64.60	65.65	97.24	96.57	96.57	95.24	97.90	83.20	73.08	73.08
41	64.80	55.00	38.00	40.00	40.00	38.00	40.00	75.83	95.90	95.80	97.24	97.90	99.23	96.00	96.00	99.20
42	112.80	110.76	108.80	110.78	110.78	85.87	87.87	85.85	103.23	101.23	99.90	100.57	99.23	111.80	106.24	103.20
43	95.70	118.80	32.00	34.00	28.00	32.00	30.00	50.70	101.90	103.90	101.23	105.23	103.90	82.80	88.40	75.52
44	106.68	104.68	104.68	104.68	104.68	61.72	65.70	65.65	105.23	99.90	105.89	104.56	106.56	91.00	72.96	89.70
45	67.60	72.80	38.00	36.00	36.00	36.00	34.00	60.70	105.23	99.90	105.89	104.56	106.56	91.00	72.96	89.70
46	128.82	126.82	126.82	126.80	126.80	65.58	68.74	73.68	97.24	96.57	96.57	95.24	97.90	83.20	73.08	73.08
47	85.68	93.24	46.00	44.00	44.00	46.00	42.00	75.83	95.90	95.80	97.24	97.90	99.23	96.00	96.00	99.20
48	120.84	120.84	124.84	122.86	122.86	40.00	34.00	78.85	103.23	101.23	99.90	100.57	99.23	111.80	106.24	103.20
49	91.50	101.26	36.00	36.00	40.00	36.00	34.00	50.70	101.90	103.90	101.23	105.23	103.90	82.80	88.40	75.52
50	130.90	128.88	120.90	122.90	122.90	86.86	83.86	78.85	105.23	99.90	105.89	104.56	106.56	91.00	72.96	89.70
51	95.16	103.70	40.00	40.00	30.00	32.00	34.00	60.70	105.23	99.90	105.89	104.56	106.56	91.00	72.96	89.70
52	138.84	136.88	128.88	132.88	132.88	65.59	50.70	65.65	105.23	99.90	105.89	104.56	106.56	91.00	72.96	89.70
53	66.00	92.40	54.00	48.00	40.00	40.00	42.00	60.70	105.23	99.90	105.89	104.56	106.56	91.00	72.96	89.70
54	140.88	128.86	138.90	138.88	140.88	57.65	60.70	73.68	98.57	99.90	99.23	103.23	109.89	78.00	72.00	92.04
55	82.80	98.00	52.00	42.00	48.00	50.00	50.00	89.06	101.90	92.57	90.58	89.24	89.24	89.46	80.40	81.84
56	120.88	120.90	118.90	122.94	130.100	65.60	78.73	68.75	101.90	92.57	90.58	89.24	89.24	89.46	80.40	81.84
57	89.06	88.40	32.00	30.00	28.00	28.00	30.00	61.48	101.90	92.57	90.58	89.24	89.24	89.46	80.40	81.84
58	142.82	134.72	132.70	132.68	132.68	63.60	62.62	61.48	101.90	92.57	90.58	89.24	89.24	89.46	80.40	81.84

31	63.36	80.52	60.00	62.00	62.00	64.00	64.00	95.90	95.90	99.90	99.90	101.23	100.80	98.40	96.00
	120.84	120.84	120.90	120.80	120.80	120.80	120.80	123.54	117.55	113.22	112.55	113.22	116.25	99.45	97.92
32	87.60	114.00	36.00	36.00	30.00	30.00	28.00	123.54	117.55	113.22	112.55	113.22	116.25	99.45	97.92
	155.108	153.100	144.98	142.98	144.98	144.98	144.98	107.23	106.56	103.90	108.56	107.23	84.50	85.76	79.20
33	89.46	115.20	47.00	53.00	46.00	44.00	46.00	107.23	106.56	103.90	108.56	107.23	84.50	85.76	79.20
34	130.96	128.86	132.90	130.98	130.98	130.98	130.98	89.91	84.58	89.91	87.91	86.58	88.20	82.50	82.50
	88.40	84.50	34.00	32.00	42.00	32.00	34.00	99.23	98.57	95.90	99.90	101.23	82.80	74.40	92.40
35	126.72	110.72	110.80	108.78	108.78	108.78	108.78	93.24	90.58	90.58	89.91	88.91	60.00	59.36	59.36
	70.20	68.04	54.00	38.00	30.00	30.00	32.00	95.90	95.24	94.57	95.90	95.90	75.60	80.24	76.56
36	138.80	124.86	132.78	132.84	132.84	132.84	132.84	98.57	97.24	95.90	97.24	97.24	80.40	81.60	86.40
	88.44	113.52	58.00	38.00	54.00	48.00	46.00	98.57	97.24	95.90	97.24	97.24	80.40	81.60	86.40
37	120.80	112.80	112.80	110.80	110.80	110.80	110.80	93.24	90.58	90.58	89.91	88.91	60.00	59.36	59.36
	57.20	60.50	40.00	32.00	32.00	30.00	30.00	95.90	95.24	94.57	95.90	95.90	75.60	80.24	76.56
38	120.84	118.84	116.84	116.86	116.86	116.86	116.86	98.57	97.24	95.90	97.24	97.24	80.40	81.60	86.40
	76.56	69.60	36.00	34.00	32.00	30.00	30.00	98.57	97.24	95.90	97.24	97.24	80.40	81.60	86.40
39	120.88	120.86	120.84	120.86	120.86	120.86	120.86	96.90	93.24	94.57	92.57	92.57	80.50	75.04	78.40
	90.00	104.40	32.00	34.00	36.00	34.00	34.00	110.56	110.56	110.56	113.22	113.89	93.60	104.72	89.76
40	140.78	136.78	124.74	130.76	124.76	124.76	124.76	93.24	89.91	89.91	90.58	87.91	98.56	70.80	90.86
	75.40	109.12	62.00	58.00	50.00	54.00	46.00	98.57	97.24	90.58	93.91	93.24	102.20	100.64	86.80
41	115.88	112.84	112.86	110.84	110.84	110.84	110.84	96.90	93.24	94.57	92.57	92.57	80.50	75.04	78.40
	63.80	88.00	27.00	28.00	26.00	26.00	26.00	110.56	110.56	110.56	113.22	113.89	93.60	104.72	89.76
42	144.94	136.98	136.98	140.100	142.100	142.100	142.100	93.24	89.91	89.91	90.58	87.91	98.56	70.80	90.86
	98.00	102.24	50.00	38.00	38.00	40.00	42.00	98.57	99.90	99.23	98.57	101.23	51.60	72.00	70.80
43	128.76	118.76	118.76	120.76	116.74	116.74	116.74	98.57	99.90	99.23	98.57	101.23	51.60	72.00	70.80
	66.00	90.48	52.00	42.00	42.00	44.00	42.00	93.24	95.24	94.57	99.90	94.57	61.44	59.80	70.40
44	120.88	120.90	118.90	116.90	124.90	124.90	124.90	85.91	85.25	83.25	83.92	83.25	70.80	58.00	80.30
	63.80	84.32	32.00	30.00	28.00	26.00	34.00	98.57	99.90	99.23	98.57	101.23	51.60	72.00	70.80
45	128.76	130.78	128.78	128.86	124.80	124.80	124.80	93.24	96.57	99.23	98.57	101.23	51.60	72.00	70.80
	60.16	93.00	52.00	52.00	50.00	42.00	44.00	80.59	79.92	79.92	79.92	78.59	68.90	65.00	60.00
46	118.70	116.70	110.70	112.70	110.70	110.70	110.70	93.24	96.57	99.23	98.57	101.23	51.60	72.00	70.80
	61.60	73.70	48.00	46.00	40.00	42.00	40.00	85.91	85.25	83.25	83.92	83.25	70.80	58.00	80.30
47	120.80	122.84	108.80	112.86	110.88	110.88	110.88	93.24	96.57	99.23	98.57	101.23	51.60	72.00	70.80
	112.00	124.30	40.00	38.00	28.00	26.00	22.00	80.59	79.92	79.92	79.92	78.59	68.90	65.00	60.00
48	106.68	100.70	100.70	100.70	100.70	100.70	100.70	93.24	96.57	99.23	98.57	101.23	51.60	72.00	70.80
	65.00	62.00	38.00	30.00	30.00	30.00	32.00	93.24	96.57	99.23	98.57	101.23	51.60	72.00	70.80
49	130.84	130.88	138.86	132.84	132.84	132.84	132.84	93.24	96.57	99.23	98.57	101.23	51.60	72.00	70.80
	83.16	96.36	46.00	42.00	52.00	48.00	46.00	104.56	99.90	99.23	98.57	101.23	51.60	72.00	70.80
50	130.92	128.86	130.84	128.88	126.80	126.80	126.80	104.56	99.90	99.23	98.57	101.23	51.60	72.00	70.80
	94.72	95.76	38.00	42.00	46.00	40.00	46.00	110.56	104.56	117.88	102.56	104.56	130.20	106.60	117.00
51	140.96	130.92	130.112	128.90	130.90	130.90	130.90	97.24	97.24	99.91	98.57	95.24	85.80	81.84	80.60
	102.40	104.00	44.00	38.00	18.00	38.00	38.00	116.55	126.54	113.89	106.56	110.56	112.50	99.20	92.40
52	132.80	132.80	130.70	128.84	118.84	118.84	118.84	106.56	102.56	101.23	101.90	102.56	94.72	95.00	102.92
	81.92	84.96	52.00	52.00	60.00	44.00	34.00	99.90	85.91	85.25	85.25	88.58	91.00	71.50	67.84
53	150.100	160.110	154.94	140.90	140.90	140.90	140.90	98.57	103.23	97.57	99.90	100.57	102.00	113.10	81.25
	70.00	74.20	50.00	50.00	60.00	60.00	44.00	111.89	111.22	112.55	111.22	111.89	80.64	89.06	103.66
54	128.96	120.94	124.90	130.88	124.92	124.92	124.92	112.55	104.56	101.90	102.56	101.90	112.42	87.10	78.00
	97.50	86.80	32.00	26.00	34.00	42.00	32.00	112.55	104.56	101.90	102.56	101.90	112.42	87.10	78.00
55	140.80	130.64	128.64	124.66	130.68	130.68	130.68	86.58	89.91	87.91	83.92	85.91	84.00	81.42	76.16
	66.96	74.10	60.00	66.00	64.00	58.00	62.00	99.90	85.91	85.25	85.25	88.58	91.00	71.50	67.84
56	120.88	130.90	125.84	120.90	122.90	122.90	122.90	98.57	103.23	97.57	99.90	100.57	102.00	113.10	81.25
	108.00	95.16	32.00	40.00	41.00	30.00	32.00	111.89	111.22	112.55	111.22	111.89	80.64	89.06	103.66
57	144.96	146.94	146.96	138.98	140.98	140.98	140.98	112.55	104.56	101.90	102.56	101.90	112.42	87.10	78.00
	82.80	95.20	48.00	52.00	50.00	40.00	42.00	112.55	104.56	101.90	102.56	101.90	112.42	87.10	78.00
58	146.96	134.90	130.88	132.88	130.88	130.88	130.88	86.58	89.91	87.91	83.92	85.91	84.00	81.42	76.16
	84.48	91.00	50.00	44.00	42.00	44.00	42.00	102.56	99.23	97.24	89.23	101.23	105.00	107.20	89.60
59	120.70	118.76	112.76	112.70	110.74	110.74	110.74	102.56	99.23	97.24	89.23	101.23	105.00	107.20	89.60
	64.96	71.50	50.00	42.00	36.00	42.00	36.00	96.57	93.24	91.91	93.24	91.91	76.86	66.00	56.40
60	140.84	134.82	134.82	134.82	132.82	132.82	132.82	96.57	93.24	91.91	93.24	91.91	76.86	66.00	56.40
	83.08	109.56	56.00	52.00	46.00	52.00	46.00	76.63	55.47	60.47	60.47	60.47	60.47	60.47	60.47

61	72.00	55.46	38.00	40.00	42.00	40.00	42.00	70.74	92.57	93.24	89.91	88.91	87.91	117.12	67.20	64.98
62	122.78	112.84	114.78	114.78	112.76	96.60	57.70	72.63	94.57	93.24	96.57	97.24	100.57	95.48	96.00	89.06
63	124.80	120.80	122.84	120.86	122.90	77.80	73.72	63.86	85.24	92.57	95.24	93.91	86.58	98.00	96.60	77.28
64	140.64	138.70	138.74	130.76	116.72	70.70	56.65	58.72	97.90	85.91	90.58	91.91	92.57	82.96	60.42	58.24
65	122.86	114.72	112.80	112.82	114.82	68.53	52.58	70.65	109.22	107.89	106.56	101.90	104.56	97.68	99.16	81.84
66	148.90	148.88	132.94	130.88	130.92	66.67	62.42	73.89	89.91	87.25	85.91	89.91	89.91	96.20	80.24	88.00
67	130.70	118.72	110.74	114.78	114.78	74.68	80.85	73.56	100.57	99.23	101.23	101.90	101.23	106.50	78.00	72.96
68	144.70	130.70	126.76	126.78	130.76	60.67	48.60	48.94	94.57	89.91	92.57	93.91	93.91	86.40	87.10	60.48
69	120.66	120.64	114.64	110.68	108.64	65.58	53.52	85.83	83.92	82.58	80.59	81.92	78.59	78.00	69.60	60.42
70	128.86	118.78	118.78	118.80	120.80	112.92	102.103	98.99	99.90	91.24	91.24	92.57	93.24	143.36	108.56	120.36
71	121.54	117.60	42.00	40.00	40.00	38.00	40.00	57.65	76.59	74.59	75.92	81.25	81.25	73.70	62.40	56.00
72	59.28	67.60	50.00	44.00	36.00	34.00	34.00	70.98	98.57	103.90	101.90	103.23	102.56	95.20	91.00	93.80
73	92.46	95.20	56.00	54.00	48.00	52.00	50.00	78.84	99.23	100.57	99.23	96.57	97.90	85.40	97.60	89.06
74	95.16	102.48	34.00	32.00	34.00	38.00	36.00	87.97	107.23	106.56	96.57	97.90	99.23	117.00	117.76	91.30
75	130.90	128.88	128.80	128.80	126.86	70.77	52.50	67.103	103.23	101.23	95.90	95.90	99.23	91.00	98.56	66.56
76	64.00	84.42	40.00	40.00	48.00	48.00	40.00	70.55	106.56	104.56	105.23	104.56	107.23	93.80	85.56	82.60
77	140.90	138.88	140.88	138.88	142.90	67.62	59.70	74.105	89	101.23	102.56	95.90	100.57	110.40	96.00	93.44
78	96.60	78.10	50.00	50.00	52.00	50.00	52.00	58.103	103.23	102.56	97.24	89.91	89.24	84.00	79.80	84.96
79	88.80	85.40	48.00	40.00	38.00	36.00	32.00	77.90	98.57	105.89	102.56	92.57	94.57	109.56	115.90	99.20
80	81.90	76.56	70.00	56.00	70.00	60.00	64.00	65.58	124.54	113.89	113.22	114.55	113.22	126.40	85.20	89.28
81	132.82	122.98	124.92	118.80	120.82	83.95	80.77	67.107	107.89	105.89	102.56	105.23	101.23	95.20	91.12	83.20
82	90.86	108.00	50.00	24.00	32.00	38.00	38.00	68.67	87.91	90.58	85.25	85.25	84.58	86.40	91.84	70.56
83	158.108	142.100	144.98	144.100	144.98	80.60	62.65	70.101	90	100	57	99.90	99.90	98.57	93.44	83.52
84	93.60	83.52	50.00	42.00	46.00	44.00	46.00	63.70	93.24	87.25	87.25	86.58	87.25	63.60	55.00	49.50
85	140.92	134.92	128.90	128.94	128.88	68.68	65.68	65.67	97.24	96.57	94.57	93.24	91.24	78.12	76.86	77.72
86	87.04	85.76	48.00	42.00	38.00	34.00	40.00	73.70	101.90	99.90	96.90	96.57	96.57	103.32	98.56	80.92
87	120.72	112.80	112.72	112.72	114.70	72.82	63.65	72.65	98.57	93.91	99.90	96.57	95.90	97.92	97.50	95.04
88	72.80	76.38	48.00	32.00	40.00	40.00	44.00	55.70	95.24	89.24	89.91	91.24	89.91	73.20	56.00	66.00
89	146.80	146.78	144.78	140.80	136.80	64.65	50.60	68.68	105.89	105.23	101.90	103.23	103.90	102.12	92.48	81.90
90	88.20	95.20	66.00	68.00	66.00	60.00	56.00	65.65	89.24	89.24	88.58	88.58	81.24	80.64	121.52	106.14
	64.80	58.30	40.00	34.00	34.00	32.00	34.00	75.72	98.57	93.91	99.90	96.57	95.90	97.92	97.50	95.04
	124.84	122.84	116.84	116.82	114.80	63.63	67.60	55.70	95.24	89.24	89.91	91.24	89.91	73.20	56.00	66.00
	69.60	74.10	40.00	38.00	32.00	34.00	34.00	68.68	105.89	105.23	101.90	103.23	103.90	102.12	92.48	81.90
	126.90	128.86	119.86	118.86	118.86	82.77	68.73	70.32	98.57	93.91	99.90	96.57	95.90	97.92	97.50	95.04
	86.14	82.60	36.00	42.00	33.00	32.00	32.00	65.72	98.57	93.91	99.90	96.57	95.90	97.92	97.50	95.04
	136.80	130.76	132.84	134.78	136.76	72.75	72.56	55.70	95.24	89.24	89.91	91.24	89.91	73.20	56.00	66.00
	87.10	97.92	56.00	54.00	48.00	56.00	60.00	68.68	105.89	105.23	101.90	103.23	103.90	102.12	92.48	81.90
	122.82	112.78	110.80	110.82	110.80	60.50	60.50	65.65	89.24	89.24	88.58	88.58	81.24	80.64	121.52	106.14
	60.50	77.00	40.00	34.00	30.00	28.00	30.00	75.72	98.57	93.91	99.90	96.57	95.90	97.92	97.50	95.04
	138.90	136.90	126.90	126.92	124.94	74.68	65.68	68.68	105.89	105.23	101.90	103.23	103.90	102.12	92.48	81.90
	85.68	84.32	48.00	46.00	36.00	34.00	30.00	65.65	89.24	89.24	88.58	88.58	81.24	80.64	121.52	106.14
	128.70	124.72	122.72	118.74	122.76	63.98	87.75	75.75	98.57	93.91	99.90	96.57	95.90	97.92	97.50	95.04

91	88.50	79.30	58.00	52.00	50.00	44.00	46.00	101.90	101.23	101.90	101.90	101.23	81.90	70.40	66.78
	130.	88.	128.	88.	126.	90.	126.	90.	124.	90.	63.	55.	53.	65.	63.
92	81.90	78.12	42.00	40.00	36.00	36.00	34.00	94.57	93.24	104.56	104.56	101.23	92.40	92.40	87.10
	132.	76.	120.	80.	134.	90.	140.	82.	70.	77.	65.	55.	65.	55.	65.
93	73.70	91.00	56.00	40.00	44.00	44.00	58.00	77.92	79.25	76.59	81.92	83.92	91.50	61.36	73.70
	122.	56.	118.	60.	110.	60.	110.	70.	75.	52.	67.	50.	80.	77.	92.
94	55.00	89.60	66.00	58.00	50.00	42.00	42.00	96.57	96.57	101.90	99.90	95.24	123.20	129.80	136.50
	110.	90.	118.	86.	130.	88.	128.	86.	126.	80.	112.	110.	105.	100.	103.
95	128.00	129.78	20.00	32.00	42.00	42.00	46.00	83.25	81.25	82.58	79.92	81.25	77.00	75.60	64.80
	110.	70.	108.	68.	108.	70.	104.	70.	70.	70.	60.	60.	67.	83.	25.
96	62.40	69.68	40.00	40.00	38.00	36.00	34.00	101.90	97.90	97.90	98.57	98.57	88.32	80.40	71.02
	138.	84.	134.	80.	134.	80.	136.	80.	64.	60.	53.	56.	53.	101.	90.
97	76.16	72.08	54.00	54.00	54.00	56.00	56.00	103.23	99.90	99.90	92.57	95.90	107.90	101.68	90.52
	130.	90.	124.	88.	124.	88.	118.	80.	120.	84.	83.	82.	73.	73.	72.
98	86.14	86.40	40.00	36.00	36.00	38.00	36.00	100.57	100.57	101.23	97.24	99.23	109.80	101.26	101.68
	122.	90.	122.	90.	124.	90.	112.	90.	118.	90.	90.	83.	82.	85.	87.
99	95.20	102.66	32.00	32.00	34.00	22.00	28.00	101.23	95.24	94.57	98.57	99.23	85.80	75.60	68.20
	132.	86.	126.	80.	124.	80.	120.	88.	118.	90.	65.	60.	55.	59.	62.
100	70.80	73.16	46.00	46.00	44.00	32.00	28.00	117.22	109.22	104.56	104.56	101.90	96.72	78.44	75.90
	156.	98.	148.	90.	138.	88.	138.	88.	138.	84.	62.	53.	55.	55.	52.
101	75.90	71.76	58.00	58.00	50.00	50.00	54.00	111.22	108.56	103.23	99.90	101.23	106.26	98.80	97.50
	138.	98.	130.	98.	130.	90.	120.	90.	120.	92.	77.	76.	75.	74.	85.
102	88.80	102.00	40.00	32.00	40.00	30.00	28.00	93.91	91.91	88.58	88.91	88.58	71.50	69.12	71.82
	130.	76.	128.	74.	126.	70.	127.	70.	122.	72.	55.	54.	57.	60.	58.
103	76.20	70.76	54.00	54.00	56.00	57.00	50.00	96.57	93.24	95.90	94.57	95.24	104.92	94.80	93.00
	122.	84.	120.	80.	124.	82.	124.	80.	122.	82.	86.	79.	75.	80.	78.
104	99.20	95.16	38.00	40.00	42.00	44.00	40.00	123.88	124.54	111.89	112.55	110.56	109.44	100.10	83.52
	152.	110.	154.	110.	144.	96.	146.	96.	140.	96.	72.	65.	58.	75.	58.
105	109.50	81.20	42.00	44.00	48.00	50.00	44.00	109.22	112.55	109.89	108.56	105.89	102.96	106.26	84.50
	132.	98.	138.	100.	130.	100.	130.	98.	130.	94.	78.	77.	65.	72.	63.
106	93.60	81.90	34.00	38.00	30.00	32.00	36.00	90.58	84.58	82.58	84.58	83.25	75.04	67.10	64.48
	112.	80.	110.	72.	104.	72.	102.	76.	102.	74.	67.	61.	62.	66.	60.
107	67.32	61.20	32.00	38.00	32.00	26.00	28.00	103.23	101.90	103.90	103.23	96.57	127.50	106.50	93.80
	150.	80.	142.	82.	140.	86.	138.	86.	130.	80.	85.	75.	67.	70.	72.
108	96.60	93.60	70.00	60.00	54.00	52.00	50.00	94.57	94.57	93.91	91.91	95.24	65.72	63.60	52.46
	124.	80.	120.	82.	122.	80.	120.	78.	118.	84.	53.	53.	43.	52.	56.
109	62.40	66.08	44.00	38.00	42.00	42.00	34.00	96.57	98.57	93.24	92.57	95.24	93.60	92.16	81.60
	130.	80.	128.	84.	120.	80.	118.	80.	118.	84.	72.	72.	68.	74.	62.
110	87.32	73.16	50.00	44.00	40.00	38.00	34.00	101.23	93.24	95.90	95.24	95.90	96.00	88.80	85.20
	128.	88.	120.	80.	120.	84.	118.	84.	120.	84.	75.	74.	71.	73.	75.
111	86.14	90.00	40.00	40.00	36.00	34.00	36.00	101.90	96.57	89.91	90.58	90.58	71.50	71.50	70.76
	130.	88.	130.	80.	122.	74.	120.	76.	120.	76.	55.	55.	58.	70.	65.
112	84.00	78.00	42.00	50.00	48.00	44.00	44.00	93.24	95.90	95.24	96.57	93.91	102.00	66.00	67.26
	120.	80.	120.	84.	118.	84.	118.	86.	118.	82.	85.	55.	57.	68.	50.
113	80.24	59.00	40.00	36.00	34.00	32.00	36.00	107.23	101.90	104.56	103.23	105.23	97.02	91.98	91.00
	126.	98.	126.	90.	130.	92.	130.	90.	132.	92.	77.	73.	70.	68.	65.
114	88.40	85.80	28.00	36.00	38.00	40.00	40.00	96.57	87.91	87.91	89.24	84.58	91.00	96.28	69.60
	130.	80.	116.	74.	116.	74.	116.	76.	114.	70.	70.	83.	60.	80.	73.
115	92.80	83.22	50.00	42.00	42.00	40.00	44.00	95.90	97.90	97.24	103.90	103.23	114.84	107.90	85.80
	132.	78.	130.	82.	132.	80.	132.	90.	130.	90.	87.	83.	65.	53.	55.
116	69.96	71.50	54.00	48.00	52.00	42.00	40.00	97.24	98.57	96.57	97.24	91.24	76.88	64.48	61.00
	124.	84.	124.	86.	122.	84.	120.	86.	122.	76.	62.	52.	50.	57.	48.
117	68.40	58.56	40.00	38.00	38.00	34.00	46.00	82.58	79.25	81.25	81.25	83.92	76.80	66.00	56.00
	120.	64.	110.	64.	112.	66.	110.	68.	112.	70.	64.	60.	50.	50.	50.
118	55.00	56.00	56.00	46.00	46.00	42.00	42.00	94.57	93.24	91.91	91.91	94.57	142.60	153.60	128.00
	124.	80.	128.	76.	128.	74.	124.	76.	128.	78.	115.	120.	100.	120.	100.
119	148.80	128.00	44.00	52.00	54.00	48.00	50.00	78.59	81.25	78.59	78.59	79.92	65.00	67.60	60.00
	100.	68.	104.	70.	100.	68.	100.	68.	100.	70.	65.	65.	60.	72.	65.
120	72.00	65.00	32.00	34.00	32.00	32.00	30.00	100.57	99.90	100.57	99.23	97.90	75.90	66.00	73.70
	138.	82.	132.	84.	134.	84.	134.	82.	130.	82.	55.	50.	55.	55.	55.
	73.70	71.50	56.00	48.00	50.00	52.00	48.00								

16. Raw data for isometric rest-hamstrings
- (a) mean blood pressure (V16-V20)
 - (b) modified tension time index (V21-V25)
 - (c) pulse pressure (V26-V30)

1	120.	84	116	84	118	84	130	86	124	88	77	80	70	82	77	95	90	94	57	95	24	100	57	99	90	92	40	92	80	82	60
2	106	60	95	48	36	00	32	00	34	00	44	00	36	00		92	57	99	23	97	24	99	90	103	90	93	50	97	94	97	44
3	90	48	93	60	26	00	28	00	22	00	24	00	24	00		103	23	104	56	102	56	102	56	103	23	120	90	75	40	85	76
4	130	90	130	92	128	90	128	90	130	38	00	40	00																		
5	76	80	83	20	40	00	38	00	38	00	38	00	40	00		104	56	98	57	103	23	101	90	104	56	74	10	64	00	74	10
6	130	92	128	84	130	90	130	88	130	92	57	50	57	54	80	105	89	103	80	100	57	99	90	103	90	87	10	90	00	87	32
7	70	20	104	00	38	00	44	00	40	00	42	00	38	00																	
8	130	94	120	96	118	92	120	90	120	96	67	75	74	80	90	83	58	96	90	85	91	85	91	85	25	74	75	59	80	64	90
9	96	00	108	00	36	00	24	00	26	00	30	00	24	00		95	24	93	24	95	90	95	90	101	23	94	40	78	00	96	00
10	115	68	115	88	118	70	118	70	120	68	65	52	55	54	80	104	56	103	90	109	89	109	89	112	55	69	54	68	40	94	90
11	63	72	96	00	47	00	27	00	48	00	48	00	52	00		107	23	106	56	106	56	104	56	107	23	84	50	85	76	79	36
12	118	84	120	80	120	84	120	84	128	88	80	65	80	72	107	89	91	89	24	87	91	84	58	85	91	62	54	71	92	64	96
13	86	40	136	96	34	00	40	00	36	00	36	00	40	00		105	23	103	90	100	57	101	90	103	90	70	72	79	20	71	50
14	122	96	120	96	130	100	130	100	130	104	57	57	73	57	80	90	58	89	91	89	91	89	91	91	24	60	32	56	10	63	80
15	74	10	104	00	26	00	24	00	30	00	30	00	26	00		105	23	103	90	100	57	101	90	103	90	70	72	79	20	71	50
16	130	96	128	96	128	96	126	94	126	98	65	57	62	60	65	90	58	89	91	89	91	89	91	91	24	60	32	56	10	63	80
17	75	60	81	90	34	00	32	00	32	00	32	00	28	00		89	91	89	24	87	91	84	58	85	91	62	54	71	92	64	96
18	118	76	116	76	112	76	110	72	110	74	53	62	58	53	73	105	23	103	90	100	57	101	90	103	90	70	72	79	20	71	50
19	58	30	80	10	42	00	40	00	36	00	38	00	36	00		90	58	89	91	89	91	89	91	91	24	60	32	56	10	63	80
20	136	90	132	90	130	86	130	88	132	90	52	60	55	50	70	105	23	103	90	100	57	101	90	103	90	70	72	79	20	71	50
21	65	00	92	40	46	00	42	00	44	00	42	00	42	00		95	24	95	24	93	24	93	91	93	91	76	70	76	70	74	34
22	116	78	110	80	110	80	110	80	110	82	52	51	58	57	65	96	57	97	24	97	90	98	57	99	23	81	74	87	60	79	06
23	118	84	118	84	118	82	116	80	114	84	65	65	63	63	74	93	24	93	24	93	24	89	91	93	91	84	57	58	24	53	76
24	73	08	84	35	34	00	34	00	36	00	36	00	30	00		96	57	97	24	97	90	98	57	99	23	81	74	87	60	79	06
25	122	84	120	86	118	88	120	88	122	88	67	73	67	65	82	91	24	91	24	91	81	91	93	91	91	73	20	73	20	95	48
26	78	00	100	04	38	00	34	00	30	00	32	00	34	00		93	24	93	24	93	24	89	91	93	91	84	57	58	24	53	76
27	122	76	122	76	124	76	122	80	124	76	60	60	77	58	78	103	90	100	57	105	23	105	23	105	89	72	00	82	60	68	20
28	70	76	96	72	46	00	46	00	48	00	42	00	48	00		100	57	102	56	104	56	105	23	105	23	75	64	86	80	79	38
29	112	84	112	84	112	84	110	80	112	86	52	48	50	53	67	87	25	85	91	82	58	83	25	86	58	58	30	65	00	59	40
30	58	30	75	04	28	00	28	00	28	00	30	00	26	00		103	90	100	57	105	23	105	23	105	89	72	00	82	60	68	20
31	122	90	124	92	126	94	124	96	124	96	62	70	63	70	80	92	57	95	90	96	57	96	57	96	57	53	10	62	40	67	26
32	86	80	99	20	32	00	32	00	32	00	32	00	28	00		79	92	81	25	79	92	78	59	78	59	44	72	52	00	55	12
33	110	76	110	74	108	70	110	70	112	74	53	60	55	52	87	89	24	90	58	88	58	90	58	89	91	92	96	95	20	106	70
34	57	20	97	44	34	00	36	00	38	00	40	00	38	00		81	92	80	59	81	25	81	25	81	25	74	20	74	20	67	60
35	120	96	118	92	124	96	124	96	126	96	60	70	55	60	70	93	24	93	24	93	24	97	24	97	24	75	60	65	00	72	00
36	74	40	88	20	24	00	26	00	28	00	28	00	30	00		102	56	101	90	100	57	95	24	95	24	115	20	126	10	98	28
37	55	46	76	70	38	00	36	00	32	00	32	00	32	00		98	23	103	23	102	56	95	90	103	90	98	90	107	90	106	64
38	104	68	104	70	104	68	104	66	104	66	43	50	53	62	45	77	80	102	56	101	90	100	57	95	24	115	20	126	10	98	28
39	64	48	46	80	36	00	34	00	36	00	38	00	38	00		98	23	103	23	102	56	95	90	103	90	98	90	107	90	106	64
40	112	78	112	80	110	78	112	80	114	78	83	85	97	85	100	89	24	90	58	88	58	90	58	89	91	92	96	95	20	106	70
41	95	20	114	00	34	00	32	00	32	00	32	00	36	00		81	92	80	59	81	25	81	25	81	25	74	20	74	20	67	60
42	106	70	106	68	104	70	104	70	104	70	70	70	65	65	75	93	24	93	24	93	24	97	24	97	24	75	60	65	00	72	00
43	67	60	78	00	36	00	38	00	34	00	34	00	34	00		102	56	101	90	100	57	95	24	95	24	115	20	126	10	98	28
44	120	80	120	80	120	80	124	84	124	84	63	55	60	60	65	98	23	103	23	102	56	95	90	103	90	98	90	107	90	106	64
45	74	40	80	60	40	00	40	00	40	00	40	00	40	00		99	90	101	23	98	57	100	57	102	56	72	00	80	60	70	80
46	128	90	130	88	126	88	120	88	118	84	90	97	78	77	80	101	90	93	24	99	90	101	90	101	23	84	50	68	40	80	60
47	92	40	94	40	38	00	42	00	38	00	32	00	34	00		102	56	101	90	100	57	95	24	95	24	115	20	126	10	98	28
48	115	90	130	90	124	92	120	84	120	96	86	83	86	78	85	98	23	103	23	102	56	95	90	103	90	98	90	107	90	106	64
49	93	60	102	00	25	00	40	00	32	00	36	00	24	00		99	90	101	23	98	57	100	57	102	56	72	00	80	60	70	80
50	120	90	124	90	120	88	122	90	120	94	60	65	59	50	70	101	90	93	24	99	90	101	90	101	23	84	50	68	40	80	60
51	61	00	84	00	30	00	34	00	32	00	32	00	26	00		102	56	99	90	101	90	100	57	99	90	80	60	74	40	101	40
52	130	88	120	80	124	88	126	90	124	90	65	57	65	60	70	102	56	99	90	101	90	100	57	99	90	80	60	74	40	101	40
53	75	60	86	80	42	00	40	00	36	00	36	00	34	00		102	56	99	90	101	90	100	57	99	90	80	60	74	40	101	40
54	124	92	124	88	130	88	122	90	120	90	65	60	78																		

61	74.80	74.80	74.80	40.00	34.00	32.00	30.00	30.00	30.00	91.91	93.91	91.24	90.58	89.91	80.40	77.52	77.52
62	120.88	74.80	74.80	42.00	30.00	34.00	32.00	30.00	30.00	95.90	99.23	95.90	96.57	99.23	91.76	85.40	90.00
63	124.82	122.88	120.84	118.86	122.88	74.70	75.78	75.78	75.78	94.57	93.24	93.24	87.91	90.58	91.00	77.52	80.24
64	92.04	91.50	42.00	34.00	36.00	32.00	34.00	32.00	34.00	98.57	94.57	91.91	92.57	91.91	62.00	71.92	61.20
65	140.72	136.72	136.72	124.70	132.70	65.57	59.68	78.78	78.78	110.56	107.89	109.89	109.89	110.56	98.00	91.08	91.00
66	84.32	102.96	68.00	64.00	64.00	54.00	62.00	78.78	78.78	95.90	90.58	89.24	88.58	92.57	95.20	87.60	78.88
67	124.86	124.80	120.78	118.80	120.78	50.58	51.54	55.55	55.55	109.22	103.90	103.90	102.56	101.23	85.84	78.40	72.08
68	63.72	66.00	38.00	44.00	42.00	38.00	42.00	100.70	69.70	91.91	99.23	95.90	95.24	96.57	80.60	69.54	60.00
69	87.10	92.40	44.00	36.00	30.00	30.00	32.00	80.64	80.64	82.58	81.25	79.92	81.25	79.92	70.20	67.60	62.40
70	140.74	120.76	116.76	118.74	118.74	80.68	73.68	80.64	80.64	103.90	103.23	97.24	96.57	99.90	79.80	73.00	76.56
71	94.40	75.52	66.00	44.00	40.00	44.00	38.00	86.53	60.53	91.91	99.23	95.90	95.24	96.57	80.60	69.54	60.00
72	148.90	140.86	136.88	132.88	132.88	56.53	53.60	53.60	53.60	88.58	91.24	89.91	85.91	82.58	114.46	130.54	94.40
73	79.20	69.96	58.00	54.00	48.00	44.00	46.00	86.65	57.50	82.58	81.25	79.92	81.25	79.92	70.20	67.60	62.40
74	124.76	122.88	120.84	118.84	118.84	68.65	65.60	68.65	68.65	103.90	103.23	97.24	96.57	99.90	79.80	73.00	76.56
75	68.44	74.34	48.00	34.00	36.00	34.00	32.00	82.58	81.25	113.89	99.90	98.57	104.56	101.23	103.32	88.80	96.00
76	120.58	110.66	110.68	110.60	112.66	60.65	58.56	48.56	48.56	96.57	95.24	98.57	95.90	97.24	91.30	90.20	92.95
77	61.60	53.76	62.00	44.00	42.00	50.00	46.00	82.57	50.58	101.90	99.90	100.57	98.57	99.90	113.10	62.40	70.56
78	126.108	120.90	120.88	122.96	120.92	82.74	80.77	82.77	82.77	105.89	103.23	101.23	101.90	102.56	75.40	74.10	76.80
79	93.94	98.40	18.00	30.00	32.00	26.00	28.00	90.83	82.83	103.23	101.23	99.90	97.90	99.23	101.40	87.60	96.00
80	110.90	110.88	112.92	108.90	112.90	83.82	83.92	88.92	88.92	93.24	88.58	92.57	90.58	93.24	70.40	58.30	62.54
81	130.88	120.90	126.88	120.88	120.88	82.82	82.82	82.82	82.82	108.55	112.55	111.22	107.89	113.22	99.16	80.04	80.04
82	55.20	102.00	42.00	30.00	38.00	32.00	30.00	84.55	53.53	110.56	107.23	107.23	107.89	108.56	88.44	85.80	94.90
83	130.94	130.90	128.88	130.88	128.88	90.58	57.60	55.55	55.55	93.24	87.25	90.58	89.91	89.91	73.92	73.70	63.84
84	71.50	70.40	36.00	40.00	40.00	42.00	38.00	88.78	73.80	75.75	75.75	75.75	75.75	75.75	74.20	72.80	74.20
85	130.90	120.92	120.90	118.88	122.88	88.78	73.80	75.75	75.75	102.56	99.90	98.57	95.90	97.90	74.20	72.80	74.20
86	88.50	91.50	40.00	28.00	30.00	30.00	34.00	84.55	53.53	110.56	107.23	107.23	107.89	108.56	88.44	85.80	94.90
87	128.76	110.78	118.80	120.76	112.84	55.53	53.54	52.59	52.59	93.24	87.25	90.58	89.91	89.91	73.92	73.70	63.84
88	62.40	66.08	52.00	32.00	38.00	44.00	28.00	84.55	53.53	110.56	107.23	107.23	107.89	108.56	88.44	85.80	94.90
89	118.88	118.80	118.90	118.86	120.86	78.93	64.78	70.77	70.77	102.56	99.90	98.57	95.90	97.90	74.20	72.80	74.20
90	82.60	92.40	30.00	38.00	28.00	32.00	42.00	84.55	53.53	110.56	107.23	107.23	107.89	108.56	88.44	85.80	94.90
91	148.104	138.100	138.98	140.92	140.92	100.67	58.58	58.58	58.58	93.24	87.25	90.58	89.91	89.91	73.92	73.70	63.84
92	81.20	98.00	44.00	38.00	40.00	48.00	40.00	84.55	53.53	110.56	107.23	107.23	107.89	108.56	88.44	85.80	94.90
93	132.100	130.96	130.96	128.98	130.98	98.67	66.73	65.65	65.65	102.56	99.90	98.57	95.90	97.90	74.20	72.80	74.20
94	83.20	84.50	32.00	34.00	34.00	30.00	32.00	80.66	67.57	92.57	94.57	95.24	92.57	95.24	73.16	74.40	62.54
95	79.20	74.80	28.00	34.00	32.00	30.00	30.00	80.66	67.57	92.57	94.57	95.24	92.57	95.24	73.16	74.40	62.54
96	140.84	140.80	140.78	132.78	134.78	80.53	52.53	54.58	54.58	102.56	99.90	98.57	95.90	97.90	74.20	72.80	74.20
97	71.28	77.72	56.00	60.00	62.00	54.00	54.00	84.55	53.53	110.56	107.23	107.23	107.89	108.56	88.44	85.80	94.90
98	118.80	120.82	118.84	118.80	118.80	84.62	62.53	54.57	54.57	92.57	94.57	95.24	92.57	95.24	73.16	74.40	62.54
99	63.72	67.26	38.00	38.00	34.00	38.00	34.00	84.55	53.53	110.56	107.23	107.23	107.89	108.56	88.44	85.80	94.90
100	124.86	120.86	118.84	114.84	112.84	77.60	65.68	68.68	68.68	92.57	94.57	95.24	92.57	95.24	73.16	74.40	62.54
101	77.52	76.16	38.00	34.00	34.00	30.00	28.00	84.55	53.53	110.56	107.23	107.23	107.89	108.56	88.44	85.80	94.90
102	118.88	118.92	118.90	118.88	118.88	90.67	62.62	67.67	67.67	92.57	94.57	95.24	92.57	95.24	73.16	74.40	62.54
103	79.06	80.24	30.00	26.00	28.00	30.00	28.00	84.55	53.53	110.56	107.23	107.23	107.89	108.56	88.44	85.80	94.90
104	136.78	120.78	120.78	126.76	120.76	72.84	52.70	65.80	65.80	92.57	94.57	95.24	92.57	95.24	73.16	74.40	62.54
105	81.90	96.00	58.00	42.00	42.00	50.00	48.00	84.55	53.53	110.56	107.23	107.23	107.89	108.56	88.44	85.80	94.90
106	112.76	110.76	112.80	112.80	112.80	80.47	51.52	58.60	58.60	87.91	87.25	90.58	90.58	90.58	52.64	56.10	58.24
107	64.96	67.20	36.00	34.00	32.00	32.00	32.00	84.55	53.53	110.56	107.23	107.23	107.89	108.56	88.44	85.80	94.90
108	132.100	124.100	122.100	126.100	130.130	100.70	78.75	77.68	77.68	110.56	107.89	107.23	108.56	109.89	92.40	96.72	91.50
109	97.02	88.40	32.00	24.00	22.00	26.00	30.00	84.55	53.53	110.56	107.23	107.23	107.89	108.56	88.44	85.80	94.90
110	118.80	118.80	120.76	114.78	118.78	63.56	60.57	60.57	60.57	92.57	92.57	90.58	89.91	91.24	74.34	66.08	72.00

17. Raw data for isometric exercise-quadriiceps
- (a) mean blood pressure (V13-V16)
 - (b) modified tension time index (V17-V20)
 - (c) pulse pressure (V21-V24)

18. Raw data for isometric exercise-hamstrings
 - (a) mean blood pressure (V13-V16)
 - (b) modified tension time index (V17-V20)
 - (c) pulse pressure (V21-V24)

1	140.110.142.110.138.98.132.96.100.96.85.85.119.88.120.55.111.22.107.85.140.00.136.32.117.30.112.20.30.00.32.00.40.00.36.00	148.120.120.96.128.84.112.88.124.95.85.87.129.20.103.90.98.57.95.90.183.52.114.00.108.80.97.44.28.00.24.00.44.00.24.00
2	162.112.170.120.140.96.126.90.82.63.70.73.128.54.136.53.110.56.101.90.132.84.107.10.98.00.91.98.50.00.50.00.44.00.36.00	170.138.160.130.144.92.130.90.108.105.58.55.148.52.139.86.109.22.103.23.183.60.168.00.83.52.71.50.32.00.30.00.52.00.40.00
3	150.120.122.100.128.96.120.90.135.98.80.76.129.87.107.23.106.56.99.90.202.50.119.56.102.40.91.20.30.00.22.00.32.00.30.00	180.110.155.96.140.84.125.80.135.76.65.62.133.20.115.55.102.56.94.90.243.00.117.80.91.00.77.50.70.00.59.00.56.00.45.00
4	140.115.155.110.144.100.128.92.150.147.88.78.123.21.124.87.114.55.103.90.210.00.227.85.126.72.99.84.25.00.45.00.44.00.36.00	180.118.150.110.150.98.142.96.115.89.70.63.138.53.123.21.115.22.111.22.207.00.133.50.105.00.89.46.62.00.40.00.52.00.46.00
5	155.112.160.112.136.102.132.96.105.105.73.65.126.21.127.87.113.22.107.89.162.75.168.00.99.28.85.80.43.00.48.00.34.00.36.00	142.92.140.110.122.84.110.84.98.87.67.60.108.56.119.88.96.57.92.57.139.16.121.80.81.74.66.00.50.00.30.00.38.00.26.00
6	168.110.160.118.150.90.136.84.108.122.78.58.129.20.131.87.109.89.101.23.181.44.195.20.117.00.78.88.58.00.42.00.60.00.52.00	148.114.132.90.126.72.120.78.124.92.75.72.125.21.103.90.89.91.91.91.183.52.121.44.94.50.86.40.34.00.42.00.54.00.42.00
7	168.120.128.92.128.84.120.88.93.93.80.70.135.86.103.90.98.57.98.57.156.24.119.04.102.40.84.00.48.00.36.00.44.00.32.00	148.102.126.106.122.88.118.86.87.87.77.76.117.22.112.55.99.23.96.57.128.76.109.62.93.94.89.68.46.00.20.00.34.00.32.00
8	190.138.168.130.138.88.122.82.150.138.86.81.155.18.142.52.104.56.95.24.285.00.231.84.118.68.98.82.52.00.38.00.50.00.40.00	156.130.150.110.128.90.118.84.124.125.65.55.138.53.123.21.102.56.95.24.193.44.187.50.83.20.64.90.26.00.40.00.38.00.34.00
9	160.128.140.100.142.98.136.98.80.78.66.73.138.53.113.22.112.55.110.56.128.00.109.20.93.72.99.28.32.00.40.00.44.00.38.00	170.92.142.98.124.80.118.72.130.110.67.60.117.88.112.55.94.57.87.25.221.00.156.20.83.08.70.80.78.00.44.00.44.00.46.00
10	170.122.142.100.140.88.130.90.125.85.50.43.137.86.113.89.105.23.103.23.212.50.120.70.70.00.55.90.48.00.42.00.52.00.40.00	152.120.155.130.138.94.118.84.103.100.63.63.130.54.138.19.108.56.95.24.156.56.155.00.86.94.74.34.32.00.25.00.44.00.34.00
11	178.110.152.108.130.80.110.68.117.118.78.55.132.53.122.54.96.57.81.92.208.26.179.36.101.40.60.50.68.00.44.00.50.00.42.00	150.100.136.96.118.80.112.78.155.145.100.94.116.55.109.22.92.57.89.24.232.50.197.20.118.00.105.28.50.00.40.00.38.00.34.00
12	142.110.124.84.112.70.108.74.94.82.66.62.120.55.97.24.83.92.85.25.133.48.101.68.73.92.66.96.32.00.40.00.42.00.34.00	170.130.152.110.150.96.140.88.116.103.82.63.143.19.123.88.113.89.105.23.197.20.156.56.123.00.88.20.40.00.42.00.54.00.52.00
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19. Raw data for comparison of isokinetic and isometric exercise-heart rate

1	104	61	125
2	145	62	140
3	132	63	137
4	130	64	150
5	137	65	155
6	110	66	183
7	115	67	133
8	113	68	115
9	135	69	147
10	118	70	177
11	120	71	158
12	135	72	186
13	90	73	110
14	108	74	132
15	136	75	80
16	140	76	107
17	135	77	113
18	162	78	140
19	125	79	150
20	100	80	101
21	143	81	112
22	165	82	95
23	130	83	132
24	163	84	108
25	115	85	115
26	153	86	113
27	140	87	133
28	135	88	117
29	140	89	90
30	137	90	160
31	115	91	125
32	150	92	115
33	132	93	133
34	128	94	174
35	134	95	90
36	116	96	140
37	130	97	100
38	142	98	124
39	145	99	82
40	143	100	108
41	138	101	135
42	193	102	135
43	123	103	150
44	125	104	115
45	150	105	105
46	175	106	98
47	165	107	108
48	180	108	124
49	112	109	93
50	153	110	87
51	138	111	150
52	120	112	124
53	150	113	80
54	130	114	130
55	135	115	125
56	135	116	103
57	127	117	117
58	135	118	155
59	142	119	94
60	144	120	116

20. Raw data for comparison of isokinetic and isometric exercise-systolic blood pressure

1	210	61	160
2	164	62	168
3	210	63	176
4	198	64	170
5	160	65	192
6	170	66	144
7	190	67	158
8	160	68	146
9	150	69	190
10	198	70	170
11	188	71	192
12	190	72	162
13	168	73	140
14	164	74	134
15	192	75	168
16	205	76	180
17	188	77	160
18	160	78	184
19	148	79	150
20	140	80	170
21	170	81	162
22	162	82	150
23	162	83	190
24	140	84	150
25	180	85	150
26	180	86	152
27	180	87	160
28	190	88	160
29	180	89	154
30	190	90	160
31	170	91	172
32	170	92	210
33	170	93	150
34	156	94	152
35	180	95	132
36	168	96	172
37	158	97	140
38	150	98	148
39	192	99	162
40	170	100	170
41	199	101	150
42	158	102	180
43	146	103	140
44	142	104	180
45	182	105	155
46	140	106	142
47	196	107	168
48	155	108	148
49	150	109	168
50	170	110	148
51	210	111	190
52	190	112	156
53	170	113	160
54	180	114	170
55	180	115	170
56	180	116	152
57	170	117	178
58	152	118	150
59	168	119	142
60	160	120	170

21. Raw data for comparison of isokinetic and
isometric exercise - diastolic blood pressure

1	66	61	38
2	54	62	55
3	68	63	20
4	10	64	60
5	48	65	40
6	60	66	40
7	60	67	35
8	64	68	58
9	68	69	24
10	56	70	10
11	58	71	15
12	50	72	10
13	54	73	110
14	70	74	110
15	20	75	110
16	72	76	138
17	54	77	110
18	54	78	110
19	40	79	110
20	52	80	130
21	15	81	120
22	40	82	118
23	55	83	130
24	25	84	98
25	56	85	94
26	58	86	104
27	76	87	110
28	25	88	124
29	62	89	120
30	68	90	120
31	50	91	124
32	68	92	140
33	62	93	116
34	64	94	90
35	45	95	100
36	72	96	130
37	25	97	110
38	48	98	120
39	20	99	112
40	50	100	138
41	55	101	120
42	25	102	110
43	45	103	115
44	50	104	118
45	20	105	112
46	30	106	92
47	5	107	110
48	10	108	114
49	60	109	120
50	72	110	102
51	55	111	138
52	30	112	130
53	45	113	128
54	60	114	92
55	44	115	122
56	62	116	120
57	76	117	110
58	68	118	100
59	48	119	110
60	38	120	130

22. Raw data for comparison of isokinetic and isometric
exercise - mean blood pressure

1	113.89	61	78.59
2	90.58	62	92.57
3	115.22	63	71.93
4	72.59	64	96.57
5	85.25	65	90.58
6	96.57	66	74.59
7	103.23	67	75.92
8	95.90	68	87.25
9	95.24	69	79.25
10	103.23	70	63.27
11	101.23	71	73.93
12	96.57	72	60.61
13	91.91	73	119.88
14	101.23	74	117.88
15	77.26	75	129.20
16	116.22	76	151.85
17	98.57	77	126.54
18	89.24	78	134.53
19	75.92	79	123.21
20	81.25	80	143.19
21	66.60	81	133.87
22	80.59	82	128.54
23	90.58	83	149.85
24	63.27	84	115.22
25	97.24	85	112.55
26	98.57	86	119.88
27	110.56	87	126.54
28	79.92	88	135.86
29	101.23	89	131.20
30	108.56	90	133.20
31	89.91	91	139.86
32	101.90	92	163.17
33	97.90	93	127.21
34	94.57	94	110.56
35	89.91	95	110.56
36	103.90	96	143.86
37	69.26	97	119.88
38	81.92	98	129.20
39	77.26	99	128.54
40	89.91	100	148.52
41	102.90	101	129.87
42	69.26	102	133.20
43	78.59	103	123.21
44	80.59	104	138.53
45	73.93	105	126.21
46	66.60	106	108.56
47	68.60	107	129.20
48	58.27	108	125.21
49	89.91	109	135.86
50	104.56	110	117.22
51	106.56	111	155.18
52	83.25	112	138.53
53	86.58	113	138.53
54	99.90	114	117.88
55	89.24	115	137.86
56	101.23	116	130.54
57	107.23	117	132.53
58	95.90	118	116.55
59	87.91	119	120.55
60	78.59	120	143.19

23. Raw data for comparison of isokinetic and isometric exercise - modified tension time index

1	218.40	61	200.00
2	237.80	62	235.20
3	277.20	63	241.10
4	257.40	64	255.00
5	219.20	65	297.60
6	187.00	66	263.50
7	218.50	67	210.10
8	180.80	68	167.90
9	202.50	69	279.30
10	233.60	70	300.90
11	225.60	71	303.30
12	256.50	72	301.30
13	151.20	73	154.00
14	177.10	74	176.88
15	261.10	75	134.40
16	287.00	76	192.60
17	253.80	77	180.80
18	259.20	78	257.60
19	185.00	79	225.00
20	140.00	80	171.70
21	243.10	81	181.44
22	267.30	82	142.50
23	210.60	83	250.80
24	228.20	84	162.00
25	207.00	85	172.50
26	275.40	86	171.76
27	252.00	87	212.80
28	256.50	88	187.20
29	252.00	89	138.60
30	260.30	90	256.00
31	195.50	91	215.00
32	255.00	92	241.50
33	224.40	93	199.50
34	199.60	94	264.48
35	241.20	95	118.80
36	194.80	96	240.80
37	205.40	97	140.00
38	213.00	98	183.52
39	278.40	99	132.84
40	243.10	100	183.60
41	274.60	101	202.50
42	304.90	102	243.00
43	179.50	103	210.00
44	177.50	104	207.00
45	273.00	105	162.75
46	245.00	106	139.16
47	323.40	107	181.44
48	279.00	108	183.52
49	168.00	109	156.24
50	260.10	110	128.76
51	289.80	111	285.00
52	228.00	112	193.44
53	255.00	113	128.00
54	234.00	114	221.00
55	243.00	115	212.50
56	243.00	116	156.56
57	215.90	117	208.26
58	205.20	118	232.50
59	238.50	119	133.48
60	230.40	120	197.20

24. Raw data for comparison of isokinetic and isometric exercise - pulse pressure

122.00	144.00
113.00	110.00
156.00	142.00
110.00	188.00
152.00	112.00
104.00	110.00
123.00	130.00
88.00	96.00
166.00	82.00
160.00	142.00
177.00	130.00
152.00	140.00
30.00	114.00
24.00	94.00
58.00	172.00
42.00	133.00
50.00	134.00
74.00	106.00
40.00	108.00
40.00	88.00
42.00	155.00
32.00	122.00
60.00	107.00
52.00	115.00
56.00	124.00
48.00	122.00
50.00	104.00
36.00	165.00
34.00	118.00
40.00	122.00
48.00	120.00
70.00	102.00
34.00	108.00
62.00	92.00
32.00	135.00
42.00	96.00
30.00	133.00
28.00	102.00
50.00	172.00
32.00	120.00
30.00	144.00
70.00	133.00
25.00	101.00
62.00	92.00
43.00	162.00
50.00	110.00
58.00	191.00
34.00	145.00
48.00	90.00
46.00	98.00
52.00	155.00
26.00	160.00
32.00	125.00
78.00	120.00
48.00	136.00
32.00	118.00
68.00	94.00
50.00	84.00
32.00	120.00
40.00	122.00

APPENDIX M
Format Statements

1. Format statement for calculation of isokinetic rest-heart rate

```
RUN NAME          ISOKRESTHR SCORES
FILE NAME         ISOKRESTHR
VARIABLE LIST     VAR1 TO VAR54
INPUT FORMAT      FIXED(2(18F3.0/))(18F3.0))
INPUT MEDIUM     DISK
N OF CASES        24
ANOVAR            WLABELS=SPEED(LOW,MED,HI) BY
                  REST(R1,R2,R3,R4,R5,R6) BY
                  TRIALS(T1,T2,T3)/
                  MEASURES=VAR1 TO VAR54
STATISTICS        ALL
READ INPUT DATA
FINISH
```


2. Format statement for calculation of isokinetic rest-blood pressure

(a) systolic

```

RUN NAME          ISOKRESTBP SCORES
FILE NAME         ISOKRESTBP
VARIABLE LIST     V1 TO V108
INPUT FORMAT      FIXED(5(18F3.0/))(18F3.0))
INPUT MEDIUM     DISK
TASK NAME         SYSTOLIC
ANOVAR           WLABELS=SPEED(LOW,MED,HI) BY
                  REST(1,2,3,4,5,6) BY
                  TRIALS(1,2,3)/
                  MEASURES=V1 V3 V5 V7 V9 V11 V13
                  V15 V17 V19 V21 V23 V25 V27 V29
                  V31 V33 V35 V37 V39 V41 V43 V45
                  V47 V49 V51 V53 V55 V57 V59 V61
                  V63 V65 V67 V69 V71 V73 V75 V77
                  V79 V81 V83 V85 V87 V89 V91 V93
                  V95 V97 V99 V101 V103 V105 V107
STATISTICS        ALL
READ INPUT DATA
FINISH

```

(b) diastolic

```

RUN NAME          ISOKRESTBP SCORES
FILE NAME         ISOKRESTBP
VARIABLE LIST     V1 TO V108
INPUT FORMAT      FIXED(5(18F3.0/))(18F3.0))
INPUT MEDIUM     DISK
TASK NAME         DIASTOLIC
ANOVAR           WLABELS=SPEED(LOW,MED,HI) BY
                  REST(1,2,3,4,5,6) BY
                  TRIALS(1,2,3)/
                  MEASURES= V2 V4 V6 V8 V10 V12 V14 V16
                  V18 V20 V22 V24 V26 V28 V30 V32 V34
                  V36 V38 V40 V42 V44 V46 V48 V50 V52
                  V54 V56 V58 V60 V62 V64 V66 V68 V70
                  V72 V74 V76 V78 V80 V82 V84 V86 V88
                  V90 V92 V94 V96 V98 V100 V102
                  V104 V106 V108
STATISTICS        ALL
READ INPUT DATA
FINISH

```


3. Format statement for calculation of isokinetic exercise-heart rate

```

RUN NAME          ISO SCORES
FILE NAME         ISOKEHR
VARIABLE LIST     VAR1 TO VAR12
INPUT FORMAT      FIXED(12F3.0)
INPUT MEDIUM     DISK
N OF CASES        24
ANOVAR            WLABELS=SPEED(LOW,MED,HI) BY TRIAL(T1,T2,T3,T4)/
                  MEASURES=VAR1 TO VAR12
OPTIONS           1
STATISTICS        ALL
READ INPUT DATA
FINISH

```

4. Format statement for calculation of isokinetic exercise-blood pressure-systolic and diastolic

```

RUN NAME          ISOKEBP SCORES
FILE NAME         ISOKEBP
VARIABLE LIST     V1 TO V24
INPUT FORMAT      FIXED(12(F3.0,F2.0))
INPUT MEDIUM     DISK
TASK NAME         SYSTOLIC
ANOVAR            WLABELS=SPEED(LOW,MED,HI) BY
                  TRIALS(T1,T2,T3,T4)/
                  MEASURES=V1 V3 V5 V7 V9 V11 V13 V15 V17 V19 V21 V23
STATISTICS        ALL
TASK NAME         DIASTOLIC
ANOVAR            WLABELS=SPEED(LOW,MED,HI) BY
                  TRIALS(T1,T2,T3,T4)/
                  MEASURES=V2 V4 V6 V8 V10 V12 V14 V16 V18 V20 V22 V24
STATISTICS        ALL
FINISH

```


5. Format statement for calculation of isometric rest-
quadriceps-heart rate

```

RUN NAME      ISOMRESTQDHR SCORES
FILE NAME     ISOMRESTQDHR
VARIABLE LIST V1 TO V5
INPUT FORMAT  FIXED(5F3.0)
INPUT MEDIUM DISK
IF            (SEQNUM LE 24) GROUPS=1
IF            (SEQNUM GE 25 AND SEQNUM LE 48) GROUPS=2
IF            (SEQNUM GE 49 AND SEQNUM LE 72) GROUPS=3
IF            (SEQNUM GE 73 AND SEQNUM LE 96) GROUPS=4
IF            (SEQNUM GE 97 AND SEQNUM LE 120) GROUPS=5
TASK NAME     HEART RATE
ANOVAR        3GROUPS=GROUPS(5)/
              #LABELS=TRIALS(1,2,3,4,5)/
              MEASURES=V1 TO V5

STATISTICS    ALL
FINISH

```


6. Format statement for calculation of isometric rest-
quadriceps-blood pressure

(a) systolic

```

RUN NAME          ISOMRESTQDBP SCORES
FILE NAME         DATAISOMREST
VARIABLE LIST     V1 TO V10
INPUT FORMAT      FIXED(10F3.0)
INPUT MEDIUM     DISK
IF                (SEQNUM LE 24) GROUPS=1
IF                (SEQNUM GE 25 AND SEQNUM LE 48) GROUPS=2
IF                (SEQNUM GE 49 AND SEQNUM LE 72) GROUPS=3
IF                (SEQNUM GE 73 AND SEQNUM LE 96) GROUPS=4
IF                (SEQNUM GE 97 AND SEQNUM LE 120) GROUPS=5
TASK NAME         SYSTOLIC
ANOVAR            BGROUPS=GROUPS(5)/
                  WLABELS=TRIALS(1,2,3,4,5)/
                  MEASURES=V1 V3 V5 V7 V9
STATISTICS        ALL
FINISH

```

(b) diastolic

```

RUN NAME          ISOMRESTQDBP SCORES
FILE NAME         DATAISOMREST
VARIABLE LIST     V1 TO V10
INPUT FORMAT      FIXED(10F3.0)
INPUT MEDIUM     DISK
IF                (SEQNUM LE 24) GROUPS=1
IF                (SEQNUM GE 25 AND SEQNUM LE 48) GROUPS=2
IF                (SEQNUM GE 49 AND SEQNUM LE 72) GROUPS=3
IF                (SEQNUM GE 73 AND SEQNUM LE 96) GROUPS=4
IF                (SEQNUM GE 97 AND SEQNUM LE 120) GROUPS=5
TASK NAME         DIASTOLIC
ANOVAR            BGROUPS=GROUPS(5)/
                  WLABELS=TRIALS(1,2,3,4,5)/
                  MEASURES=V2 V4 V6 V8 V10
STATISTICS        ALL
FINISH

```


7. Format statement for calculation of isometric rest-hamstrings-heart rate

```

RUN NAME          ISOMRESTHMHR SCORES
FILE NAME         ISOMRESTHMHR
VARIABLE LIST     V1 TO V5
INPUT FORMAT      FIXED(5F3.0)
INPUT MEDIUM     DISK
IF                (SEQNUM LE 24) GROUPS=1
IF                (SEQNUM GE 25 AND SEQNUM LE 48) GROUPS=2
IF                (SEQNUM GE 49 AND SEQNUM LE 72) GROUPS=3
IF                (SEQNUM GE 73 AND SEQNUM LE 96) GROUPS=4
IF                (SEQNUM GE 97 AND SEQNUM LE 120) GROUPS=5
TASK NAME         HEART RATE
ANOVAR            BGROUPS=GROUPS(5)/
                  WLABELS=TRIALS(1,2,3,4,5)/
                  MEASURES=V1 TO V5
STATISTICS        ALL
FINISH

```


8. Format statement for calculation of isometric rest-hamstrings-blood pressure

(a) systolic

```

RUN NAME      ISOMRESTHMBP SCORES
FILE NAME     ISOMRESTHMBP
VARIABLE LIST V1 TO V10
INPUT FORMAT  FIXED(10F3.0)
INPUT MEDIUM DISK
IF            (SEQNUM LE 24) GROUPS=1
IF            (SEQNUM GE 25 AND SEQNUM LE 48) GROUPS=2
IF            (SEQNUM GE 49 AND SEQNUM LE 72) GROUPS=3
IF            (SEQNUM GE 73 AND SEQNUM LE 96) GROUPS=4
IF            (SEQNUM GE 97 AND SEQNUM LE 120) GROUPS=5
TASK NAME     SYSTOLIC
ANOVAR        BGROUPS=GROUPS(5)/
              WLABELS=TRIALS(1,2,3,4,5)/
              MEASURES=V1 V3 V5 V7 V9
STATISTICS    ALL
FINISH

```

(b) diastolic

```

RUN NAME      ISOMRESTHMBP SCORES
FILE NAME     ISOMRESTHMBP
VARIABLE LIST V1 TO V10
INPUT FORMAT  FIXED(10F3.0)
INPUT MEDIUM DISK
IF            (SEQNUM LE 24) GROUPS=1
IF            (SEQNUM GE 25 AND SEQNUM LE 48) GROUPS=2
IF            (SEQNUM GE 49 AND SEQNUM LE 72) GROUPS=3
IF            (SEQNUM GE 73 AND SEQNUM LE 96) GROUPS=4
IF            (SEQNUM GE 97 AND SEQNUM LE 120) GROUPS=5
TASK NAME     DIASTOLIC
ANOVAR        BGROUPS=GROUPS(5)/
              WLABELS=TRIALS(1,2,3,4,5)/
              MEASURES=V2 V4 V6 V8 V10
STATISTICS    ALL
FINISH

```


9. Format statement for calculation of isometric exercise-
quadriceps-heart rate

```

RUN NAME      ISOMEXQDHR SCORES
FILE NAME     ISOMEXQDHR
VARIABLE LIST VAR1 TO VAR4
INPUT FORMAT  FIXED(4F3.0)
INPUT MEDIUM DISK
N OF CASES    24
ANOVAR        WLABELS=TREATMENT(1,2,3,4)/
               MEASURES=VAR1 TO VAR4
OPTIONS       1
STATISTICS    ALL
READ INPUT DATA
FINISH

```

10. Format statement for calculation of isometric exercise-
quadriceps-blood pressure

(a) systolic

(b) diastolic

```

RUN NAME      ISOMEXQDBP SCORES
FILE NAME     ISOMEXQDBP
VARIABLE LIST V1 TO V8
INPUT FORMAT  FIXED(8F3.0)
INPUT MEDIUM DISK
TASK NAME     SYSTOLIC
ANOVAR        WLABELS=REST(1,2,3,4)/
               MEASURES=V1 V3 V5 V7
STATISTICS    ALL
FINISH

```

```

RUN NAME      ISOMEXQDBP SCORES
FILE NAME     ISOMEXQDBP
VARIABLE LIST V1 TO V8
INPUT FORMAT  FIXED(8F3.0)
INPUT MEDIUM DISK
TASK NAME     DIASTOLIC
ANOVAR        WLABELS=REST(1,2,3,4)/
               MEASURES=V2,V4,V6,V8
STATISTICS    ALL
READ INPUT DATA
FINISH

```


11. Format statement for calculation of isometric
exercise-hamstrings-heart rate

```

RUN NAME          ISOMEXHMMHR SCORES
FILE NAME         ISOMEXHMMHR
VARIABLE LIST     VAR1 TO VAR4
INPUT FORMAT      FIXED(4F3.0)
INPUT MEDIUM     DISK
N OF CASES        24
ANOVAR            WLABELS=TREATMENT(1,2,3,4)/
                  MEASURES=VAR1 TO VAR4
OPTIONS           1
STATISTICS        ALL
READ INPUT DATA
FINISH

```

12. Format statement for calculation of isometric
exercise-hamstrings-blood pressure

(a) systolic

(b) diastolic

```

RUN NAME          ISOMEXHMBP SCORES
FILE NAME         ISOMEXHMBP
VARIABLE LIST     V1 TO V8
INPUT FORMAT      FIXED(8F3.0)
INPUT MEDIUM     DISK
TASK NAME         SYSTOLIC
ANOVAR            WLABELS=REST(1,2,3,4)/
                  MEASURES=V1,V3,V5,V7
STATISTICS        ALL
READ INPUT DATA
FINISH

```

```

RUN NAME          ISOMEXHMBP SCORES
FILE NAME         ISOMEXHMBP
VARIABLE LIST     V1 TO V8
INPUT FORMAT      FIXED(8F3.0)
INPUT MEDIUM     DISK
TASK NAME         DIASTOLIC
ANOVAR            WLABELS=REST(1,2,3,4)/
                  MEASURES=V2,V4,V6,V8
STATISTICS        ALL
READ INPUT DATA
FINISH

```


13. Format statement for calculation of mean blood pressure, modified tension time index and pulse pressure from raw data

```

R FILE=ISOKEXBP FORMAT=(12(F3.0,F2.0)) VAR=1-24 CASES=1-24 L=*
R FILE=ISOKEXHR FORMAT=12F3.0 VAR=25-36 CASES=1-24 L=*
TRANS RESULT=101-112 FUNCTION=MULTIPLY VAR=1,3,5,7,9,11,13,15,17,19,21,23;0.333 CASES=ALL L=*
TRANS RESULT=113-124 FUNCTION=MULTIPLY VAR=2,4,6,8,10,12,14,16,18,20,22,24;0.666 L=*
TRANS RESULT=37-48 FUNCTION=ADD VAR=101-112;113-124 L=*
TRANS RESULT=201-212 FUNCTION=MULTIPLY VAR=1,3,5,7,9,11,13,15,17,19,21,23;25-36 CASES=ALL L=*
TRANS RESULT=49-60 FUNCTION=DIVIDE VAR=201-212;100.0 L=*
TRANS RESULT=61-72 FUNCTION=SUBTRACT VAR=1,3,5,7,9,11,13,15,17,19,21,23;2,4,6,8,10,12,14,16,18,20,22,24 L=*
WRITE FILE=-KEX FORMAT=36F4.0,36F7.2 VAR=1-72 CASES=ALL

```


14. Format statement for calculation of mean blood pressure, modified tension time index and pulse pressure form isokinetic rest

```

RUN NAME
FILE NAME
VARIABLE LIST
INPUT FORMAT
INPUT MEDIUM
TASK NAME
ANOVAR

ISOKREST SCORES
ISOKREST
V1 TO V108
FIXED(27F4.O,27F7.2/27F4.O,27F7.2)
DISK
MEAN BLOOD PRESSURE ANALYSIS
WLABELS=TRIALS(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18)/
MEASURES=V28 V29 V30 V31 V32 V33 V34 V35 V36 V82 V83 V84 V85 V86 V87 V88 V89
V87 V88 V89 V90

STATISTICS
TASK NAME
ANOVAR

MTTI ANALYSIS
WLABELS=TRIALS(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18)/
MEASURES=V37 V38 V39 V40 V41 V42 V43 V44 V45 V91 V92 V93 V94 V95 V96 V97 V98 V99
V96 V97 V98 V99

STATISTICS
TASK NAME
ANOVAR

PULSE PRESSURE ANALYSIS
WLABELS=TRIALS(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18)/
MEASURES=V46 V47 V48 V49 V50 V51 V52 V53 V54 V100 V101 V102 V103 V104 V105 V106 V107 V108
V104 V105 V106 V107 V108

STATISTICS
FINISH

```


15. Format statement for calculation of mean blood pressure, modified tension time index and pulse pressure for isokinetic exercise

```

RUN NAME          ISOKEK SCORES
FILE NAME         ISOKEK
VARIABLE LIST     V1 TO V72
INPUT FORMAT      FIXED(36F4.0,36F7.2)
INPUT MEDIUM     DISK
TASK NAME         MEAN BLOOD PRESSURE ANALYSIS
ANOVAR            WLABELS=TRIALS(1,2,3,4,5,6,7,8,9,10,11,12)/
                  MEASURES=V37 V38 V39 V40 V41 V42 V43 V44 V45 V46 V47 V48

STATISTICS        ALL
TASK NAME         MTTI ANALYSIS
ANOVAR            WLABELS=TRIALS(1,2,3,4,5,6,7,8,9,10,11,12)/
                  MEASURES=V49 V50 V51 V52 V53 V54 V55 V56 V57 V58 V59 V60

STATISTICS        ALL
TASK NAME         PULSE PRESSURE ANALYSIS
ANOVAR            WLABELS=TRIALS(1,2,3,4,5,6,7,8,9,10,11,12)/
                  MEASURES=V61 V62 V63 V64 V65 V66 V67 V68 V69 V70 V71 V72

STATISTICS        ALL
FINISH

```

16. Format statement for calculation of mean blood pressure, modified tension time index and pulse pressure for isometric rest-quadriceps and isometric rest-hamstrings

```

RUN NAME          ISOMRESTHM SCORES
FILE NAME         ISOMRESTHM
VARIABLE LIST     V1 TO V30
INPUT FORMAT      FIXED(15F4.0,15F7.2)
INPUT MEDIUM     DISK
TASK NAME         MEAN BLOOD PRESSURE ANALYSIS
ANOVAR            WLABELS=TRIALS(1,2,3,4,5)/
                  MEASURES=V16 V17 V18 V19 V20

STATISTICS        ALL
TASK NAME         MTTI
ANOVAR            WLABELS=TRIALS(1,2,3,4,5)/
                  MEASURES=V21 V22 V23 V24 V25

STATISTICS        ALL
TASK NAME         PULSE PRESSURE ANALYSIS
ANOVAR            WLABELS=TRIALS(1,2,3,4,5)/
                  MEASURES=V26 V27 V28 V29 V30

STATISTICS        ALL
FINISH

```


17. Format statement for calculation of mean blood pressure, modified tension time index and pulse pressure for isometric exercise - quadriceps and isometric exercise-quadriceps

```

RUN NAME          ISOMEXHM SCORES
FILE NAME         ISOMEXHM
VARIABLE LIST     V1 TO V24
INPUT FORMAT      FIXED(12F4.0,12F7.2)
INPUT MEDIUM     DISK
TASK NAME         MEAN BLOOD PRESSURE ANALYSIS
ANOVAR            WLABELS=TRIALS(1,2,3,4)/
                  MEASURES=V13 V14 V15 V16

STATISTICS        ALL
TASK NAME         MTTI
ANOVAR            WLABELS=TRIALS(1,2,3,4)/
                  MEASURES=V17 V18 V19 V20

STATISTICS        ALL
TASK NAME         PULSE PRESSURE ANALYSIS
ANOVAR            WLABELS=TRIALS(1,2,3,4)/
                  MEASURES=V21 V22 V23 V24

STATISTICS        ALL
FINISH

```


18. Format statement for comparison of isokinetic and isometric exercise - heart rate

- (a) statement to get raw data combination of maximum isokinetic exercise (first exercise bout) and maximum voluntary contraction in isometric exercise (using * midas)

```

READ FILE=ISOKEXHR FORMAT=3X,I3 VAR=1 LABEL=HEART1 CASES=1-24
READ FILE=ISOKEXHR FORMAT=15X,I3 VAR=1 LABEL=HEART2 CASES=25-48
READ FILE=ISOKEXHR FORMAT=27X,I3 VAR=1 LABEL=HEART3 CASES=49-72
READ FILE=ISOMEXQDHR FORMAT=I3 VAR=1 LABEL=HEART4 CASES=73-96
READ FILE=ISOMEXHMHHR FORMAT=I3 VAR=1 LABEL=HEART5 CASES=97-120
WRITE FILE=HEART10 FORMAT=I3 VAR=1 CASES=ALL
FINISH

```

- (b) statement to compare isokinetic and isometric exercise by one way analysis of variance (using * spss)

```

RUN NAME          COMHEART
FILE NAME         COMHEART
VARIABLE LIST     V1
INPUT FORMAT      FIXED(F3.0)
INPUT MEDIUM     DISK
SUBFILE LIST      HEART1(24),HEART2(24),HEART3(24),HEART4(24),HEART5(24)
ONEWAY            V1 BY SUBFILES/RANGES=SCHEFFE/
STATISTICS        ALL
FINISH

```


19. Format statement for comparison of isokinetic and isometric exercise - systolic blood pressure

- (a) statement to get raw data combination of maximum isokinetic exercise (first exercise bout) and maximum voluntary contraction in isometric exercise (using * midas)

```

READ FILE=ISOKEXPB FORMAT=5X,I3 VAR=1 LABEL=SYSTOLIC1 CASES=1-24
READ FILE=ISOKEXPB FORMAT=25X,I3 VAR=1 LABEL=SYSTOLIC2 CASES=25-48
READ FILE=ISOKEXPB FORMAT=45X,I3 VAR=1 LABEL=SYSTOLIC3 CASES=49-72
READ FILE=ISOMEXQDBP FORMAT=I3 VAR=1 LABEL=SYSTOLIC4 CASES=73-96
READ FILE=ISOMEXHMBP FORMAT=I3 VAR=1 LABEL=SYSTOLIC5 CASES=97-120
WRITE FILE=SYSTOLIC10 FORMAT=I3 VAR=1 CASES=ALL
FINISH

```

- (b) statement to compare isokinetic and isometric exercise by one way analyses of variance (using * spss)

```

RUN NAME          COMSYSTOLIC
FILE NAME         COMSYSTOLIC
VARIABLE LIST     V1
INPUT FORMAT      FIXED(F3.0)
INPUT MEDIUM     DISK
SUBFILE LIST      SYSTOL1(24),SYSTOL2(24),SYSTOL3(24),SYSTOL4(24),SYSTOL5(24)
ONEWAY            V1 BY SUBFILES/RANGES=SCHEFFE/
STATISTICS        ALL
FINISH

```


20. Format statement for comparison of isokinetic and isometric exercise - diastolic blood pressure

- (a) statement to get raw data combination of maximum isokinetic exercise (first exercise bout) and maximum voluntary contraction in isometric exercise (using * midas)

```

READ FILE=ISOKEGBP FORMAT=8X,I2 VAR=1 LABEL=DIASTOLIC1 CASES=1-24
READ FILE=ISOKEGBP FORMAT=28X,I2 VAR=1 LABEL=DIASTOLIC2 CASES=25-48
READ FILE=ISOKEGBP FORMAT=48X,I2 VAR=1 LABEL=DIASTOLIC3 CASES=49-72
READ FILE=ISOMEXQDBP FORMAT=3X,I3 VAR=1 LABEL=DIASTOLIC4 CASES=73-96
READ FILE=ISOMEXHMBP FORMAT=3X,I3 VAR=1 LABEL=DIASTOLIC5 CASES=97-120
WRITE FILE=DIASTOLIC10 FORMAT=I3 VAR=1 CASES=ALL

```

- (b) statement to compare isokinetic and isometric exercise by one way analyses of variance (using *, spss)

```

RUN NAME          COMDIASTOLIC
FILE NAME         COMDIASTOLIC
VARIABLE LIST     V1
INPUT FORMAT      FIXED(F3.0)
INPUT MEDIUM     DISK
SUBFILE LIST      DIASTOL1(24),DIASTOL2(24),DIASTOL3(24),DIASTOL4(24),DIASTOL5(24)
ONEWAY            V1 BY SUBFILES/RANGES=SCHEFFE/
STATISTICS        ALL
FINISH

```


21. Format statement for comparison of isokinetic and isometric exercise - mean blood pressure

- (a) statement to get raw data combination of maximum isokinetic exercise (first exercise bout) and maximum voluntary contraction in isometric exercise (using * midas)

```

READ FILE=ISOKEK FORMAT=(T153,F6.2) VAR=1 LABEL=MBP1 CASES=1-24
READ FILE=ISOKEK FORMAT=(T182,F6.2) VAR=1 LABEL=MBP2 CASES=25-48
READ FILE=ISOKEK FORMAT=(T210,F6.2) VAR=1 LABEL=MBP3 CASES=49-72
READ FILE=ISOMEXQD FORMAT=(T50,F6.2) VAR=1 LABEL=MBP4 CASES=73-96
READ FILE=ISOMEXHM FORMAT=(T50,F6.2) VAR=1 LABEL=MBP5 CASES=97-120
WRITE FILE=MBP10 FORMAT=F7.2 VAR=1 CASES=ALL
FINISH
STOP

```

- (b) statement to compare isokinetic and isometric exercise by one way analyses of variance (using * spss)

```

RUN NAME          COMMBP
FILE NAME         COMMBP
VARIABLE LIST     V1
INPUT FORMAT      FIXED(F7.2)
INPUT MEDIUM     DISK
SUBFILE LIST      MBP1(24),MBP2(24),MBP3(24),MBP4(24),MBP5(24)
ONEWAY            V1 BY SUBFILES/RANGES=SCHEFFE/
STATISTICS        ALL
FINISH

```


22. Format statement for comparison of isokinetic and isometric exercise - modified tension time index

- (a) statement to get raw data combination of maximum isokinetic exercise (first exercise bout) and maximum voluntary contraction in isometric exercise (using * midas)

```

READ FILE=ISOKEK FORMAT=(T236,F6.2) VAR=1 LABEL=MTTI1 CASES=1-24
READ FILE=ISOKEK FORMAT=(T264,F6.2) VAR=1 LABEL=MTTI2 CASES=25-48
READ FILE=ISOKEK FORMAT=(T292,F6.2) VAR=1 LABEL=MTTI3 CASES=49-72
READ FILE=ISOMEXQD FORMAT=(T78,F6.2) VAR=1 LABEL=MTTI4 CASES=73-96
READ FILE=ISOMEXHM FORMAT=(T78,F6.2) VAR=1 LABEL=MTTI5 CASES=97-120
WRITE FILE=MTTI100 FORMAT=F7.2 VAR=1 CASES=ALL
FINISH

```

- (b) statement to compare isokinetic and isometric exercise by one way analyses of variance (using * spss)

```

1      RUN NAME      COMMTTI
2      FILE NAME     COMMTTI
3      VARIABLE LIST  V1
3.5    INPUT FORMAT  FIXED(F7.2)
5      INPUT MEDIUM  DISK
6      SUBFILE LIST   MTTI1(24),MTTI2(24),MTTI3(24),MTTI4(24),MTTI5(24)
8      ONEWAY         V1 BY SUBFILES/RANGES=SCHEFFE/
9      STATISTICS     ALL
10     FINISH
END OF FILE

```


23. Format statement for comparison of isokinetic and isometric exercise - pulse pressure

- (a) statement to get raw data combination of maximum isokinetic exercise (first exercise bout) and maximum voluntary contraction in isometric exercise (using * midas)

```

READ FILE=ISOKEK FORMAT=(T320,F6.2) VAR=1 LABEL=PP1 CASES=1-24
READ FILE=ISOKEK FORMAT=(T349,F6.2) VAR=1 LABEL=PP2 CASES=25-48
READ FILE=ISOKEK FORMAT=(T378,F6.2) VAR=1 LABEL=PP3 CASES=49-72
READ FILE=ISOMEXQD FORMAT=(T107,F6.2) VAR=1 LABEL=PP4 CASES=73-96
READ FILE=ISOMEXHM FORMAT=(T107,F6.2) VAR=1 LABEL=PP5 CASES=97-120
WRITE FILE=PP10 FORMAT=F7.2 VAR=1 CASES=ALL
FINISH

```

- (b) statement to compare isokinetic and isometric exercise by one way analyses of variance (using * spss)

```

RUN NAME          COMPP
FILE NAME         COMPP
VARIABLE LIST     V1
INPUT FORMAT      FIXED(F7.2)
INPUT MEDIUM     DISK
SUBFILE LIST      PP1(24),PP2(24),PP3(24),PP4(24),PP5(24)
ONEWAY            V1 BY SUBFILES/RANGES=SCHEFFE/
STATISTICS        ALL
FINISH

```


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